LOGY DEPT.

POWER

JUNE 1945

PUBLIC LIBRARY
JUN 194
DE

GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

TH WAR LOAN

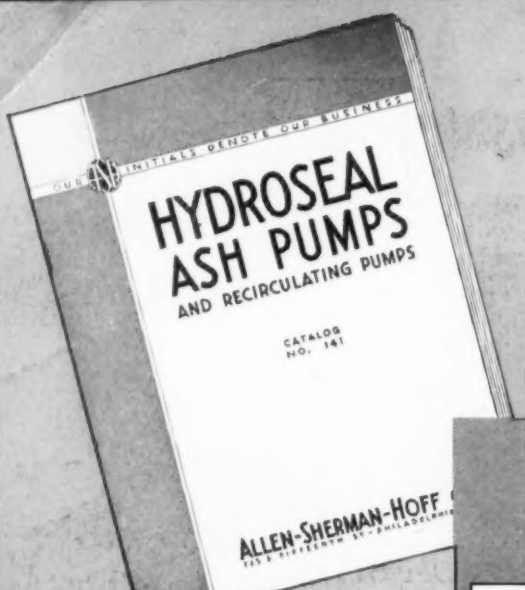
TO THE AMERICAN PEOPLE:

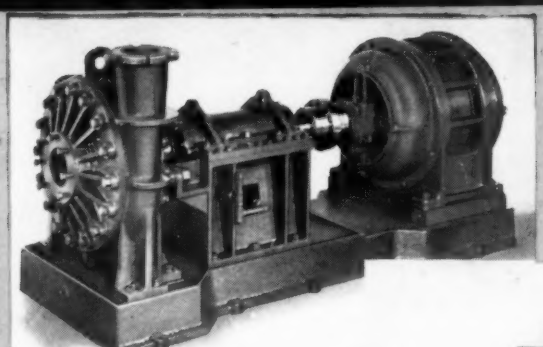
Your sons, husbands and brothers who are standing today upon the battlefronts are fighting for more than victory in war. They are fighting for a new world of freedom and peace.

We, upon whom has been placed the responsibility of leading the American forces, appeal to you with all possible earnestness to invest in War Bonds to the fullest extent of your capacity.

Give us not only the needed implements of war, but the assurance and backing of a united people so necessary to hasten the victory and speed the return of your fighting men.

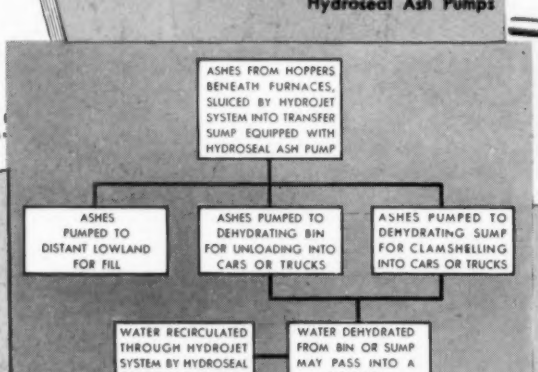
William D. Leahy
Douglas MacArthur Ernest J. King
Dwight D. Eisenhower Chester W. Nimitz
H. H. Arnold

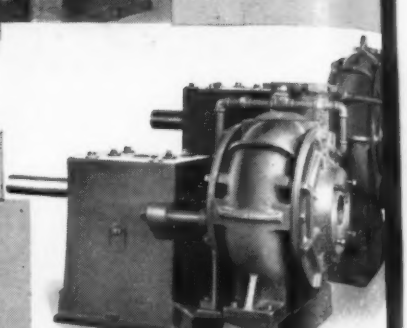




Hydroseal Recirculating Pump

Hydroseal Ash Pumps

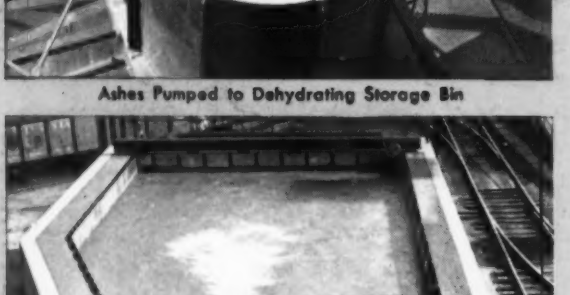

ASHES FROM HOPPERS BENEATH FURNACES, SLUICED BY HYDROJET SYSTEM INTO TRANSFER SUMP EQUIPPED WITH HYDROSEAL ASH PUMP
ASHES PUMPED TO DISTANT LOWLAND FOR FILL
ASHES PUMPED TO DEHYDRATING BIN FOR UNLOADING INTO CARS OR TRUCKS
ASHES PUMPED TO DEHYDRATING SUMP FOR CLAMSHELLING INTO CARS OR TRUCKS
WATER RECIRCULATED THROUGH HYDROJET SYSTEM BY HYDROSEAL RECIRCULATING PUMP
WATER DEHYDRATED FROM BIN OR SUMP MAY PASS INTO A CLEARWELL



Ashcolite Pipe used with Hydraulic Ash Handling

Pumping Ashes to Distant Fill

Ashes Pumped to Dehydrating Storage Bin



Ashes Pumped to Dewatering Grab Bucket Sump

Guidebook For Planning Your Post War Ash And Dust Disposal

"PUMP YOUR ASHES" has been our cry, ever since the earliest days of the Hydrojet System. Hydroseal Pumps are now used under practically every conceivable condition, handling everything from stoker ash to precipitator dust. In practically every case, we have found that hydraulic ash handling is the most inexpensive method where the engineer considers maintenance, labor and power, in addition to first cost. . . . Hydroseal Ash and Recirculating Pumps are specially designed for economical handling of abrasive solutions. Before you get too far with your post war plans, get our Catalog No. 141, or talk to our nearest engineer.

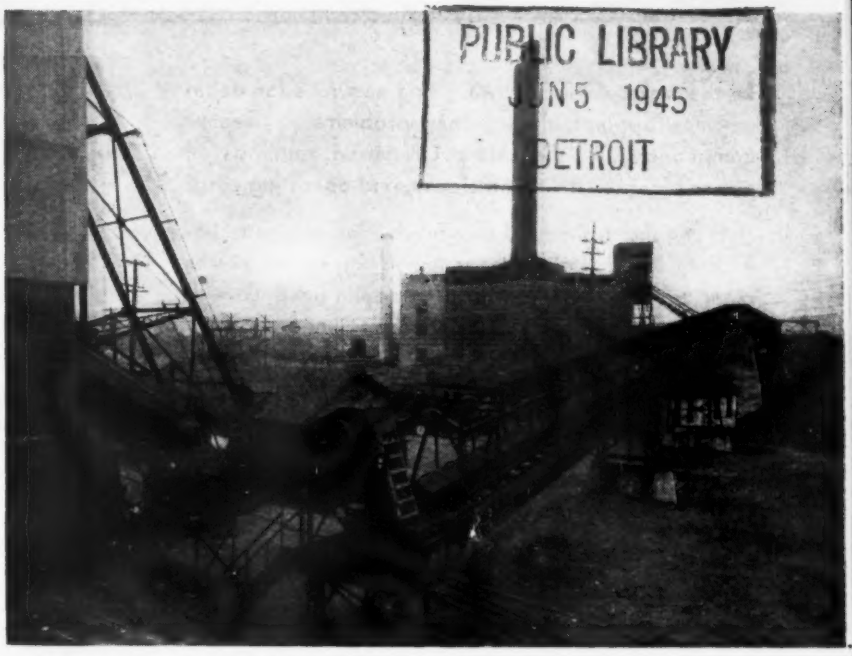
HYDROSEAL PUMPS

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA 2, PA. ***Offices & Representatives in Principal Cities***

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), June, 1945, Vol. 89, No. 6. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years, Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

Mine-to-Power-House Conveyor Cuts Coal Handling Costs • • •

PUBLIC LIBRARY
JUN 5 1945
DETROIT



Above: Pennsylvania Electric Co. steam-electric generating station at Seward, Pa. Belt conveyor No. 1 is shown, also the inclined steel apron conveyor that feeds it.

Below is a view of reserve coal pile, showing conveyor No. 1 and stocking-out conveyor.

• Savings in handling costs and increased coal storage capacity are being realized by Pennsylvania Electric Company, by the use of a Link-Belt belt conveyor system operating between mine tipple and power house or stock pile.

Replacing thirty-eight railroad cars, two steam locomotives and a locomotive crane, the new system requires only the aid of a bulldozer in stocking-out and reclaiming the coal from reserve ground storage pile.

Coal of 6-inch size and under (with occasional larger lumps) is carried at the rate of 250 tons an hour at 450 ft. per minute. The coal comes from a company mine 800 ft. from the power house. A 24″ x 440′ centers belt conveyor takes the coal to a Bradford type breaker and cleaner. Another conveyor 24″ x 347′ centers takes the crushed coal to belt conveyor and tripper extending over length of power house coal bunker. A 24″ x 58′ long belt conveyor on an incline, mounted on a steel boom, is used for stocking-out coal on ground. Link-Belt belt conveyor equipment provides a practical way to increase handling capacity and lower costs. Let us send you Folder 2087 on this installation, also Folder 1915 on Link-Belt belt conveyor idlers.

LINK-BELT
COAL AND ASHES HANDLING EQUIPMENT

LINK-BELT COMPANY
Chicago 9, Indianapolis 6,
Philadelphia 40, Atlanta, Dallas 1,
Minneapolis 5, San Francisco 24,
Los Angeles 33, Seattle 4,
Toronto 8.
Offices in principal cities. 9059

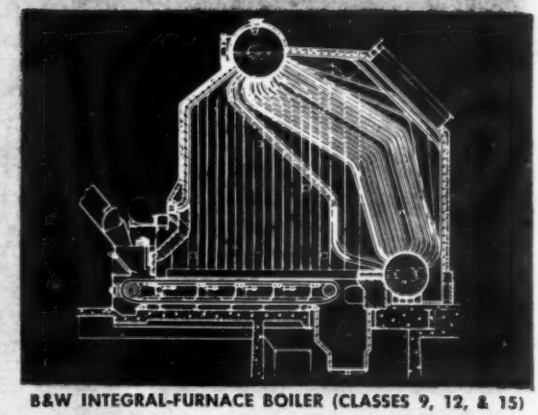
PRACTICAL PLANS for

In the wake of this war will come new jobs for steam . . . new opportunities . . . new problems . . . keener competition . . . that will put renewed emphasis on power plant reliability, efficiency, and operating costs.

When the urgency of war production begins to unwind into the pattern of peacetime competition, power plant engineers will want to be ready in advance with step-by-step plans for urgently needed modernization and expansion of existing facilities. Properly drawn, such plans will help speed reconversion of their own industries and hasten action in providing for fully integrated power services having the high overall efficiency and flexibility for changing conditions that future operations will demand.

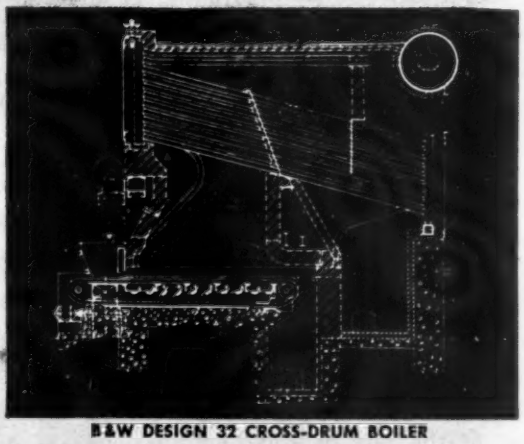
Thinking and planning for tomorrow *today* is a job B&W engineers are ready to tackle in partnership with power engineers of industry. Their long leadership in meeting steam power requirements has been greatly augmented by much more valuable experience gained in serving the industry war needs.

When the time comes to specify equipment for the future, there is a B&W boiler for any combination of conditions . . . capacity, pressure, temperature, feedwater, fuel and space . . . to be met. Whatever the type needed, it is built for the job, thus assuring the highest standards of performance, continuity of service, high overall station economy and greatest return on the investment.



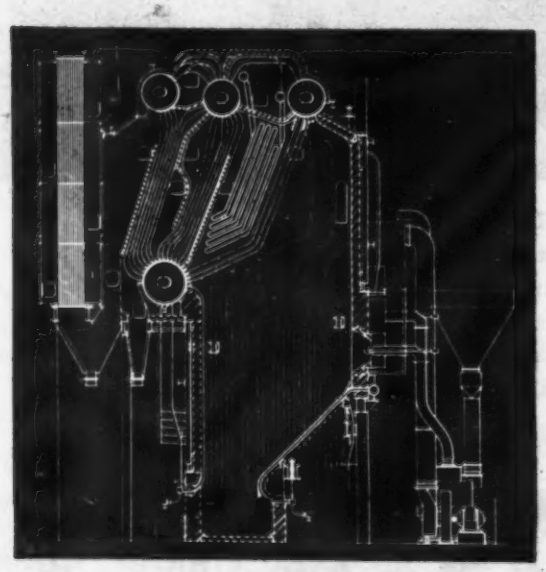
B&W INTEGRAL-FURNACE BOILER (CLASSES 9, 12, & 15)

This Integral-Furnace Boiler is available for firing with stokers or with oil, and in sizes ranging from 1353 to 6506 sq. ft. of heating surface. Having a water-cooled furnace of special design, this boiler provides the dependability of central-station boilers, with efficient and smokeless combustion.



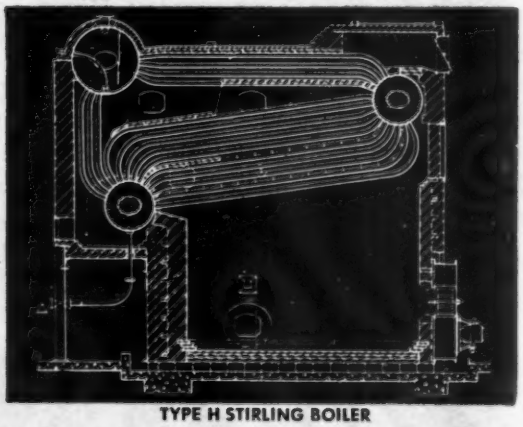
B&W DESIGN 32 CROSS-DRUM BOILER

This unit is widely used in small and medium-size power plants where refractory furnaces are suitable. It provides the advantages of the straight-tube, sectional-header construction used in B&W Cross-Drum Boilers designed for larger capacities.



STIRLING BOILER

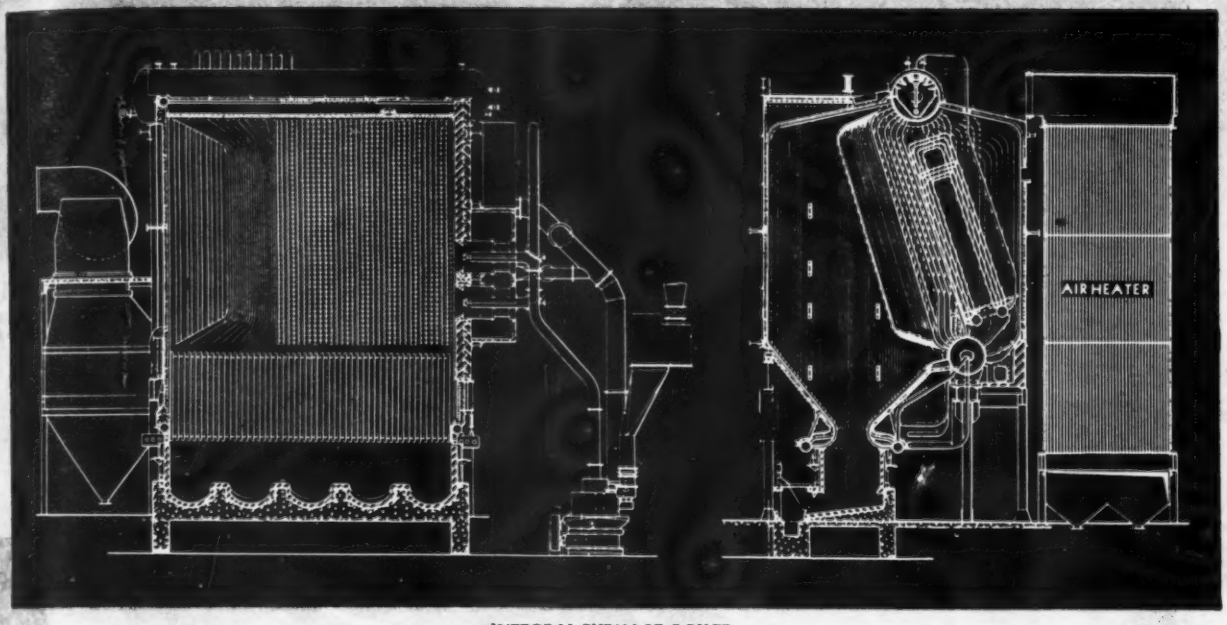
The Stirling Boiler fully meets the requirements of modern operating conditions. It readily responds to sudden and heavy demands for steam, and delivers dry steam at relatively high ratings when operated with water having a high concentration of solids. May be fired with any fuel.



TYPE H STIRLING BOILER

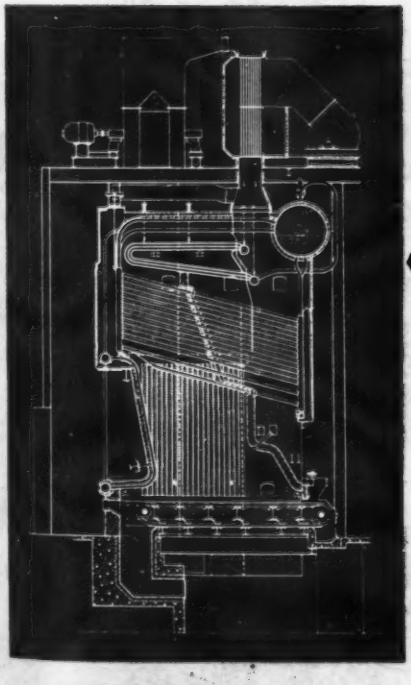
A low-head moderate-pressure unit that is widely used in small industrial plants, institutions, hotels, office buildings and to meet other similar requirements. Available in capacities ranging from 1500 to 30,000 lb. steam per hr. and for firing with any fuel. The furnace, usually of refractory, provides the necessary degree of dependability.

PEACETIME POWER . . .



INTEGRAL-FURNACE BOILER

The Integral-Furnace Boiler is a completely co-ordinated unit built in capacities up to 250,000 lb. steam per hr. and for the pressures and temperatures required by the most up-to-date and efficient prime movers. It is designed to burn pulverized solid fuels, oil, or gas, singly or in combination, thus utilizing at high combustion efficiency the least expensive fuel obtainable in any locality.

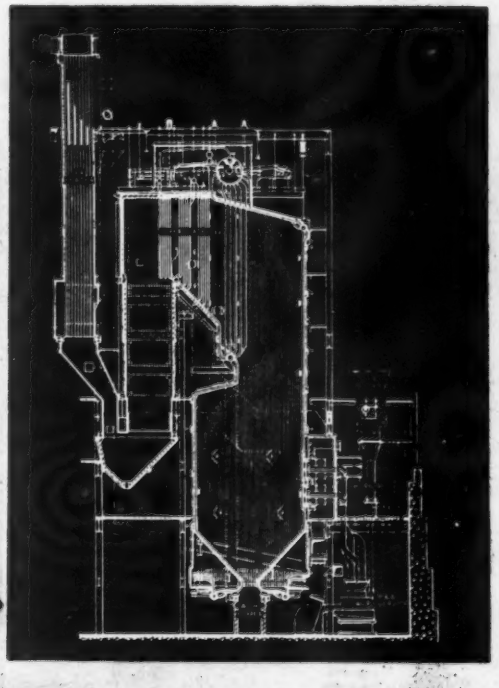


B&W CROSS-DRUM BOILER

This straight-tube sectional-header boiler is noted for its dependability, long life, and ability to deliver dry steam at high ratings. Can be readily inspected and cleaned.

CENTRAL-STATION BOILERS

High-duty boilers for central-station service are available in several basic designs to meet the requirements of individual stations. The Radiant boiler unit illustrated is typical of some of the units now operating at high rates in utility plants.



THE BABCOCK & WILCOX CO. • 85 LIBERTY STREET, NEW YORK 6, N. Y.

BABCOCK & WILCOX

G-294F

ELLIOTT
Buchi-Turbochargers

MORE POWER PER POUND FOR DIESELS

- Driven by exhaust gas—by-product power.
- No mechanical connection with engine.
- Operate always in positive rotation.
- Speed control automatic.
- Applied to 4-cycle Diesels—new or old.
- Increase power up to 50%.
- Sea-level ratings at high altitude.

Full details and bulletin at request.

M-78

ELLIOTT COMPANY

Supercharger Dept., JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.

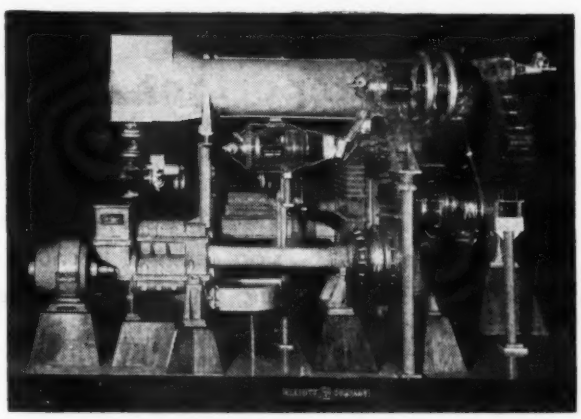
DISTRICT OFFICES IN PRINCIPAL CITIES

High speed at red heat

The Elliott-Buchi Turbocharger is an outstanding success. Almost every 4-cycle Diesel manufacturer now turbocharges, and turbocharged Diesels are fast becoming too common to excite comment. Their increased power, improved operation, and reliability are being taken as an accepted fact.

To bring the turbocharger to this successful stage was a considerable triumph for Elliott engineering. It necessitated the solution of many difficult engineering problems, such as proper turbine design for 1000°F operating temperature at high speeds, sealing hot gases, lubrication and cooling of shaft, wide spread of temperature between turbine and blower. The turbocharger must also be engineered to the individual engine. A big problem was metallurgy, and Elliott engineers have succeeded in building a unit to operate continuously throughout the life of the Diesel it serves.

Using the experience gained in the successful design of the gas-driven turbocharger, Elliott engineers have advanced the next step, to the successful design of the Elliott Gas Turbine—prime mover of the future. Complete information on this important development will be given at an early date.



Model of Elliott 2500-hp gas turbine. Actual unit is operating on test in our Jeannette plant.

PRODUCTS:

STEAM TURBINES • ELECTRIC GENERATORS AND MOTORS • BLOWERS AND COMPRESSORS
TURBOCHARGERS FOR DIESEL ENGINES • CONDENSERS • STEAM JET EJECTORS • FILTERS
FEEDWATER HEATERS AND DEAERATORS • DESUPERHEATERS • TUBE CLEANERS
GREASE EXTRACTERS • SEPARATORS • STRAINERS • NONRETURN VALVES

Only DIAMOND

Following years of work with manually operated soot blowers using compressed air as the cleaning medium, Diamond installed the first automatically operated air blowers in 1932. Since that time the continuous research, development and application engineering that has been carried on by Diamond has resulted in a "know how" that is unapproached in this field. Experience has proved that some of the problems encountered — both engineering and economic—are different than when steam is the cleaning medium.

Blower Heads Particularly Suited To Air

Experience early proved that certain heads long very successfully used for steam cleaning did not give equally satisfactory results with air as the cleaning medium. This caused the design and development of heads expressly suited to air blowing.

Diamond Developed "Air-Puff" Principle

Sixteen years ago, Diamond introduced automatic sequential "Air-Puff" soot blowing. The compressed air is discharged from the element nozzles in a series of short puffs with substantial pauses between. During each puff the element is automatically rotated to a new position. Spreading the cleaning cycle over a much longer period of time permits the use of a much smaller compressor. The "puff" principle and the long time cleaning period reduce the stack discharge to the point where it is not sufficiently noticeable to prevent daylight blowing in residential areas.

Air Cleaning Has Important Advantages

Labor saving and correct boiler cleaning are common to all Diamond automatic sequential soot blower operation. Cleaning with air instead of steam has additional important advantages: (1) feed water makeup is saved; (2) no piping insulation is required; (3) more energy is saved from the coal pile; (4) dryer blowing medium for surfaces operating near the dew point; (5) more effective medium for slag removal because of its greater density and lower temperature; (6) reduced blower maintenance.

DIAMOND POWER

HAS THIS BACKGROUND OF Experience IN AUTOMATIC SOOT BLOWING WITH Air

Power Boilers having DIAMOND Automatic Soot Blowing with AIR

* CENTRAL STATION	DATE BOILER IN SERVICE	STEAM CAPACITY OF BOILER	TYPES OF AIR BLOWING HEADS USED	METHOD OF OPERATION	METHOD OF CONTROL
A	Sept. 18, 1940	900,000 lb/hr	5	Air and Electric	Air and Electric
A	May 5, 1941	900,000 lb/hr	5	Air and Electric	Air and Electric
B	June 18, 1942	550,000 lb/hr	3	Air and Electric	Air and Electric
B	Sept. 29, 1942	900,000 lb/hr	2	Air and Electric	Air and Electric

Names and additional information furnished on request

SPECIALTY CORP. Detroit 31, Mich.

DIAMOND SPECIALTY LTD. · Windsor, Ontario

BOILER BUSINESS placed in

Reveals widespread preference for C-E Equipment

DURING the first three months of this year, many leading industrials and utilities placed orders for new steam generating units. Their conclusions as to present-day values offered by the principal boiler manufacturers are revealed in the fact that a far larger volume of this first quarter's business was placed with Combustion Engineering than with any other company in the field. Equally significant is the fact that this preference for "C-E engineered" equipment extended through virtually the entire range of steam generating conditions:

CAPACITIES from 15,000 to 600,000 lb of steam per hr.

DESIGN PRESSURES from 160 to 1475 lb per sq in.

TOTAL STEAM TEMPERATURES from saturated at 160 lb pressure to 935 F.

Other indications of the comprehensiveness of this work are:

FUELS AND FIRING — Bituminous coal as supplied from all principal mining areas, anthracite, oil, gas, bagasse, wood refuse, soda tar and acid sludge. Pulverized coal and three types of stokers are represented in the coal-fired group which comprises slightly more than half the number of units. Combination firing of pulverized coal, oil and gas is employed in one unit, and three units are designed to burn both oil and gas.

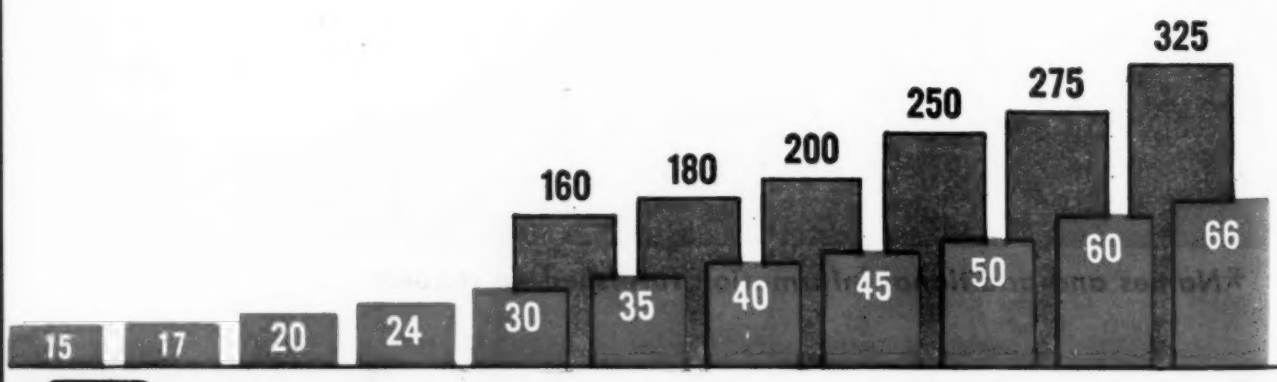
GEOGRAPHICAL — Units will be installed in the following states: Conn., N. Y., N. J., Pa., Md., Va., N. C., Fla., Ind., Ill., Mich., Wis., Minn., Mo., Kan., Ark., Colo. and Tex.; also in five Latin American countries.

INDUSTRIES — Public utility power plants, munitions, rubber, petroleum, chemicals, paper, textile, food products, sugar, tobacco and miscellaneous manufacturing.

★ ★ ★

The conclusion to be reached from all of this is that if you want the equipment comprising your next boiler unit to reflect the broadest present-day experience with fuels and operating conditions and to embody those design and construction features that are finding the widest acceptance in the field — *buy a C-E Unit.*

A-874

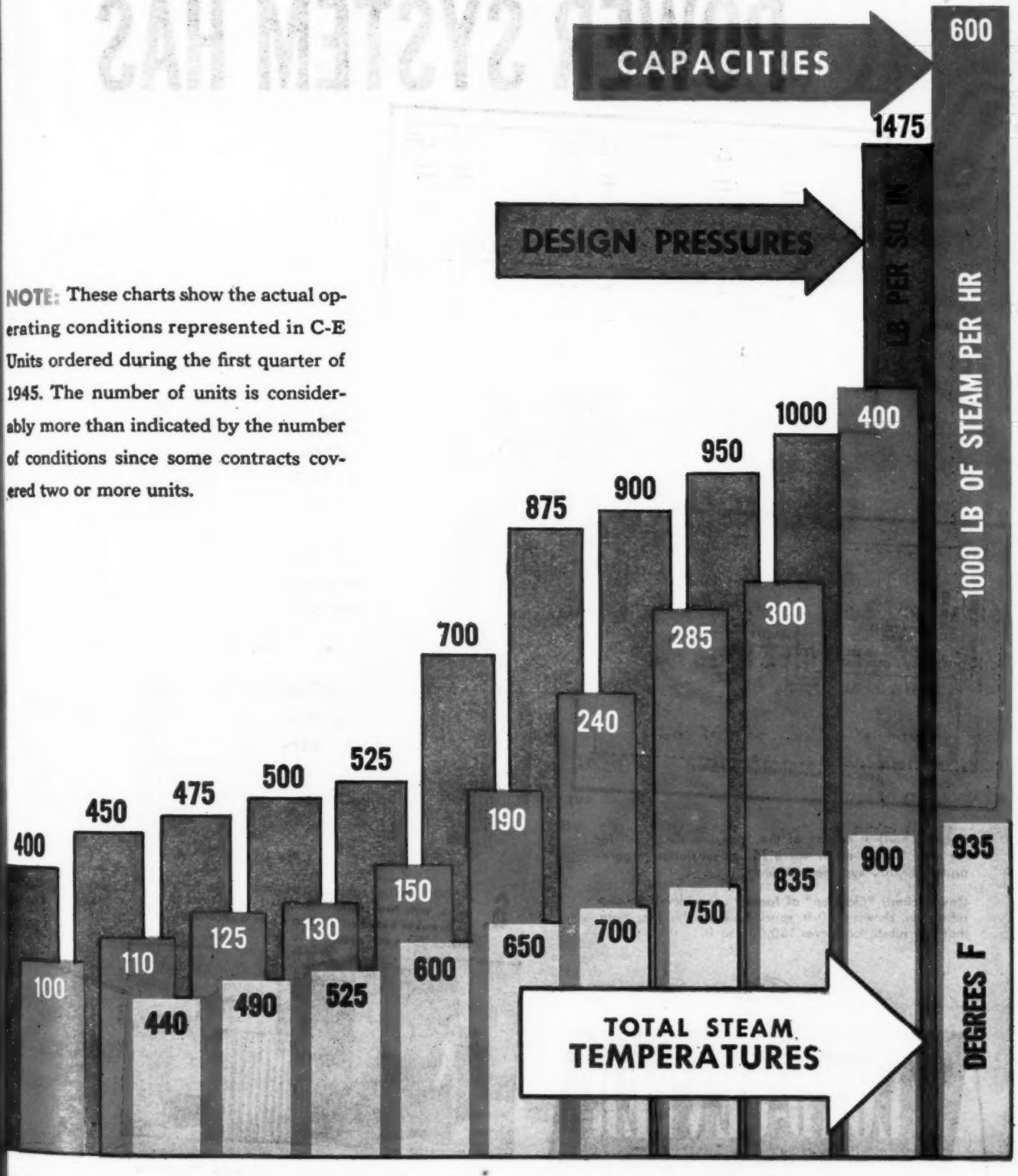


C·E

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

FIRST QUARTER of 1945

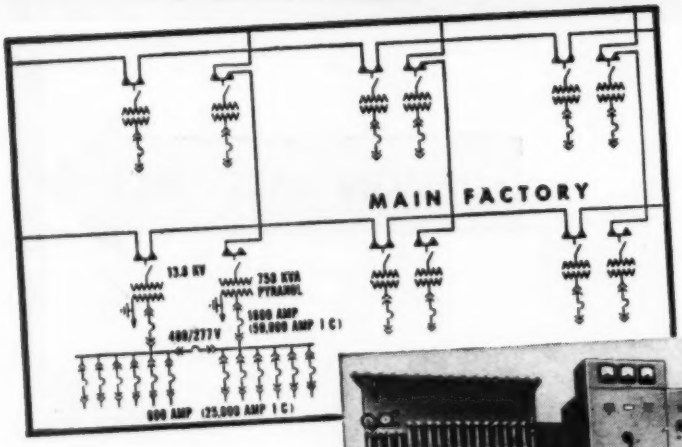


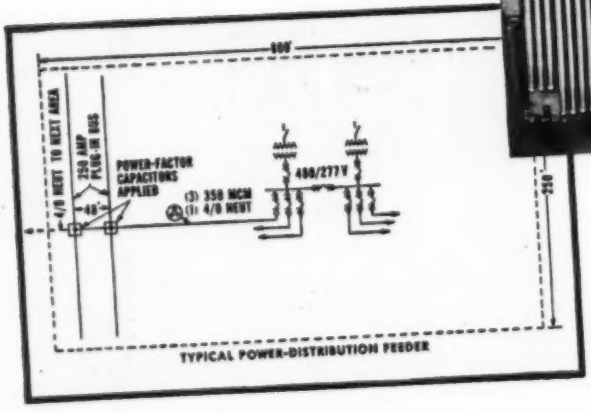
NOTE: These charts show the actual operating conditions represented in C-E Units ordered during the first quarter of 1945. The number of units is considerably more than indicated by the number of conditions since some contracts covered two or more units.

ENGINEERING

200 Madison Avenue New York 16, N. Y.

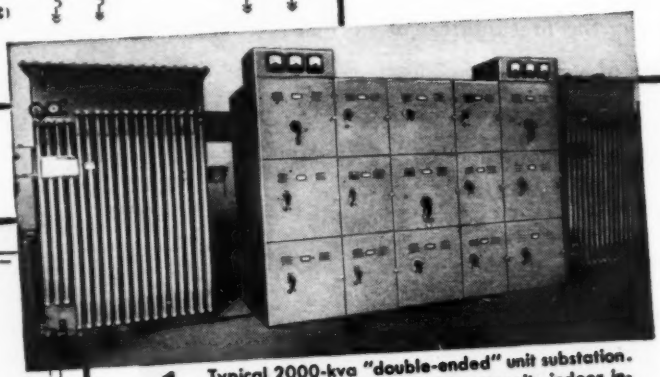
This War-Plant POWER SYSTEM HAS



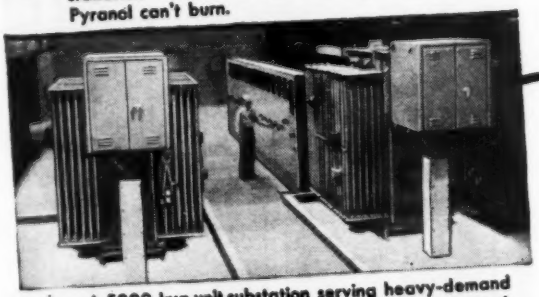


(Upper chart) A section of the "one-line diagram" for the main factory area, where 16 unit substations aggregating 30,000 kva are installed.

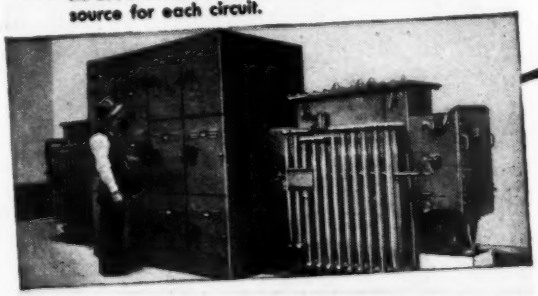
(Lower chart) "Close-up" of factory area served by one substation, showing 40-ft spacing of plug-in bus. Note that one substation serves 150,000 sq ft.



1. Typical 2000-kva "double-ended" unit substation. A Pyranol* transformer section permits indoor installation without creating a fire hazard, as Pyranol can't burn.



6. A 5000-kva unit substation serving heavy-demand area, with two sections mounted face to face. A tie breaker between the two gives a second power source for each circuit.



7. One of four 200-kva units serving the office area and basement, conveniently located in "penthouses" above the load centers.

*Trade-mark reg. U.S. Pat. Office

GE

LOAD-CENTER
Power Distribution Systems

L-L Strong Points

Designed to save on materials and manpower, this load-center installation has made an unusual operating record for safe and reliable power distribution.

Load-center unit substations are employed throughout in a *secondary selective* arrangement. The two primary feeders to every substation start from different 13.8-kv buses. Every load circuit is backed up by two independent sources of power. Yet all equipment normally shares in carrying total load. All necessary immediate switching to maintain power supply can be done at 480 volts.

Primary distribution at 13.8 kv is handled by 3-conductor feeder cables carried in overhead troughs. Overhead installation saved manpower and materials. Inspection and relocation of cables are easy.

480 Y/277-volt secondary circuits serve local load-areas by means of plug-in bus. As substations are installed on the building roof, feeder taps to each plug-in bus are short and direct.

Fluorescent lighting of factory area is supplied from the same unit substations which serve factory operation. The 277-volt operation of lights from the line-to-neutral conductors of the system is highly economical, as compared with 120- or 208-volt circuits.

Capacitors, applied close to the machine-tool motor load, add to the carrying capacity of the substations. They are ceiling-mounted in blocks of 90-kva at the feeder taps of the plug-in bus throughout the main factory area. (10,000 kva, total).

Areas of heavy demand, requiring motors of 250 hp and larger, are served by separate substations which convert from 13.8 to 2.4 kv, again using the secondary-selective principle. Within these areas, small motor and lighting loads are powered by "sub-substations" which have 2.4-kv primary and 480/277-volt secondary.

An extensive office-building area is served by unit substations having secondary circuits at 208/120 volts.

POWER SYSTEMS LIKE THIS protect operating continuity and give any plant greater flexibility to meet changing needs. They can be applied to old plants as a complete modernization project, or step by step without interrupting production. The over-all installed cost is fully predictable.

G-E application engineers will be glad to give you recommendations based on highly successful wartime installations. *General Electric Company, Schenectady 5, N. Y.*

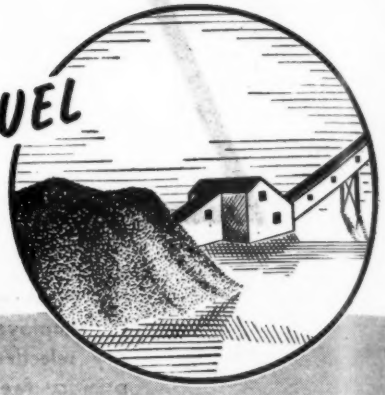
Buy all the BONDS you can—and *keep all you buy*

GENERAL ELECTRIC

302-41-5900

ENGINEERED

Conserves — FUEL



Bailey Boiler Control at the Wyandotte, Michigan Plant of Wyandotte Chemicals Corporation

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEA

INSTRUMENTATION

★ To be truly effective in the conservation of fuel, manpower, transportation, and major equipment, boiler room meters and control systems must be carefully engineered to the particular requirements of the plants which they serve.

Thorough instrumentation engineering starts with a careful consideration of improvements which may be effected; and continues through with the application, design, construction, calibration, installation and adjustment of the meters and controls necessary to secure these desired improvements.

Bailey Meter Company, through its staff of thoroughly trained and experienced combustion engineers is helping power plant engineers to achieve their wartime conservation objectives.

Bailey Engineers are stationed in over 30 industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense. The Bailey Engineer in your community has a vast store of data at his command which includes results from tests on thousands of boiler installations covering a wide range of fuels, furnaces and fuel burning equipment. You will find that he has more to offer than meters and controllers. He is primarily interested in helping you to secure maximum fuel conservation together with the other benefits which result from intelligent use of correctly selected and properly applied instrumentation. G-22

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

Bailey Meter Company Limited, Montreal, Canada

. . . . The Complete Boiler Control System

NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

Scovill Tube News

Vol. 3 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 2

Selection and Care of Condenser Tubes

Operating engineers are vitally interested in obtaining long trouble-free service life from condenser and heat exchanger tubes; maximum service can be expected only by selecting a suitable tube material for the particular application and, of equal importance, by instituting and maintaining practices for the control of certain types of corrosion.

The choice of an economical tube material requires careful consideration, and a decision should be based on the results of a study of the following controlling factors:

1. Conditions of service, including such information as operating temperature and pressure, velocity of media contacting tubes, composition of solutions, gases, vapors, being handled.
2. Previous service experience with tubes in a particular unit or similarly operated units.
3. Type or form of corrosion which predominates.
4. The inherent corrosion-resistant properties of the available tube materials.

SELECTION OF TUBE MATERIAL

Engineers have a choice of a large number of non-ferrous alloys for condenser and heat exchanger tubes. These alloys vary considerably in composition, chemical and physical properties and their ability to withstand certain types of corrosion. In many cases, the selection of a satisfactory tube material is not a difficult matter. As an example, under conditions where dezincification of condenser tubes is the major problem, the use of a dezincification-resistant tube alloy — Phosphorized Admiralty metal — is indicated; under a somewhat more limited set of conditions, Red Brass, Arsenical Copper or Deoxidized Copper may also be used to overcome tube deterioration of the dezincification type.

In another case, condenser tubes may be required to withstand the action of a high velocity circulating water or other conditions of service which would result in the rapid erosion of tube walls and, combined with corrosion, shorten the life of some tube materials to a marked degree. Conditions of this kind require the choice of tubes of erosion-resistant alloys, such as Aluminum Brass or 70–30 Copper-Nickel.

Very often, the operating conditions under which tubes must serve offer a more complex corrosion problem than the cited examples and such cases are only solved satisfactorily by close attention to all contributing factors to corrosion.

ATTENTION TO CONTRIBUTORY FACTORS

Many condenser tube corrosion problems can best be controlled by eliminating or correcting the factors contributing to corrosion. This is especially true in installations where certain types of corrosion are active. In cases of tube failures which can be attributed to "deposit attack", freedom from such attack cannot be assured by a change in tube alloy. "Deposit attack" of tube surfaces is initiated by foreign materials which are carried into the tubes by the circulating medium and become lodged on the tube walls; such materials as coal or coke, clinkers, stones, wood, paper, shells or other marine growths may contribute to this form of corrosion under certain conditions of service. Intense local pitting and downstream erosion-corrosion, characteristic of attack at and adjacent to foreign deposits, can be prevented or minimized by two expedients — adequate screening of the circulating water and a periodic thorough careful cleaning of the tubes.

Another source of tube failure has its origin in the formation of electro-chemical cells at local areas of the tube walls; this form of corrosion is called "concentration cell action." Corrosion of this type is often formed at recessed areas which may exist between tubes and tube sheets, baffles, and support plates, or at any location where cracks, crevices or other areas are found into which liquids may seep and become trapped.

Concentration cell action may also be experienced beneath porous layers of scale or corrosion product over the metal surface or at discontinuities in protective films or coatings. The remedy for overcoming corrosion of this kind again lies in certain definite precautionary or corrective measures rather than in a change in tube alloy. Briefly, all recesses, crevices, etc. at tube surfaces between tubes and tube sheets, baffles, etc. should be avoided; screening of the circulating media and cleaning of the tubes are beneficial as in the case of deposit attack; lastly, effective chemical treatment of media contacting the tubes has been helpful in many cases.

CHANGE IN OPERATING CONDITIONS

Certain unexpected corrosion problems often develop during the service life of tubes. It is not unusual to find that operating conditions change in some respect and such changes are then reflected in a different type of tube attack to that normally experienced. Thus, tube installations which have been trouble-free, may suddenly show evidence of serious corrosion.

Periodic inspection of tubes and prompt action in diagnosing the possible sources of trouble under such circumstances will often lead to remedial measures which can be applied to arrest an otherwise corrosive action on the tubes.

In some instances, as an illustration, the tubes in a unit will suddenly show definite evidence of inlet end attack although no trouble of this kind had previously been experienced. At the first indication of this trouble, a study can be made to determine what particular conditions of service are causing it, and this study can be followed by definite recommendations for alleviating the attack. If such recommendations cannot be carried out for any reason and the attack continues, a suitable coating of paint or cement can be applied to the inlet ends periodically to stop the action. More permanent relief in severe cases can be obtained by the use of properly designed metal or plastic inserts to cover affected tube areas.

THREE SCOVILL SERVICES

The foregoing information on the selection, use and care of condenser and heat exchanger tubes has been necessarily brief. The subject is covered in more detail in the Scovill Condenser Tube booklet, a copy of which will be sent upon request to Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Connecticut.

Information like this, regularly provided through "Scovill Tube News" and printed literature, is part of *Service in Manuals* — one of three Scovill services.

The other two are *Service in Men* which brings you, through Scovill engineers, specialized consultation on tube problems and installation methods . . . and *Service in Metals* which covers the selection of alloys and study of specific problems in the field and in the laboratory.

THIS IS NUMBER FIFTEEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY 91, CONN.

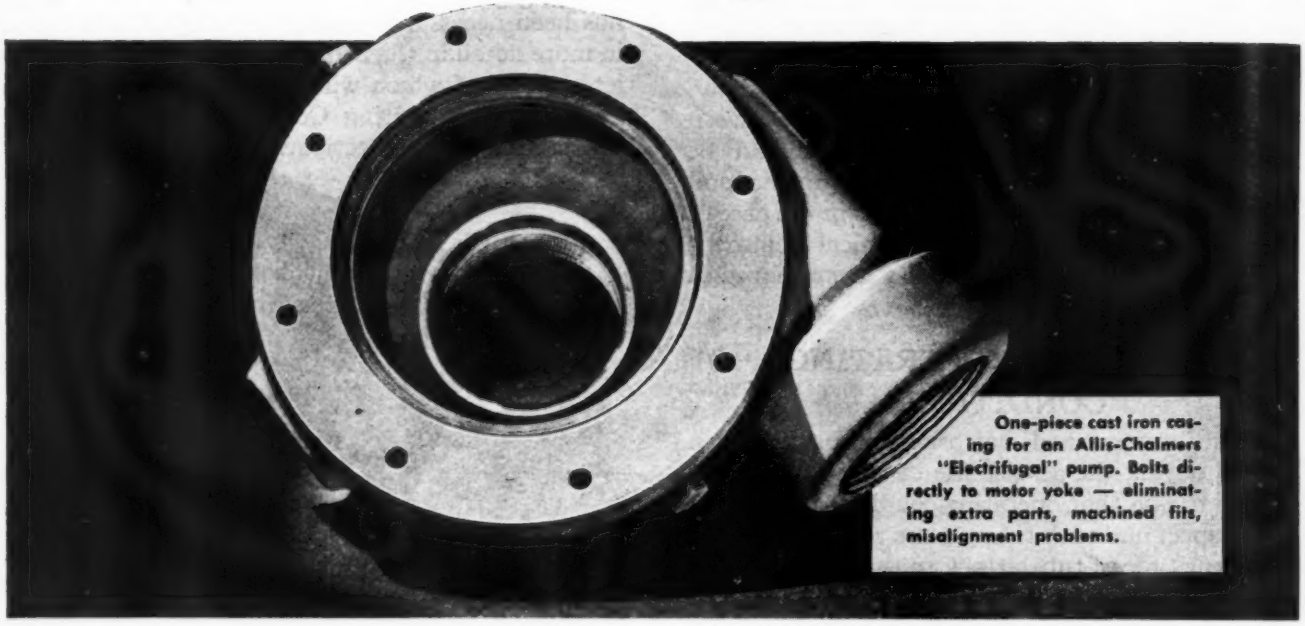
SCOVILL CONDENSER TUBES

ONE PRODUCT . . . THREE SERVICES

Service in Manuals . . . Service in Metals . . . Service in Men

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make CASINGS Last Longer . . .



One-piece cast iron casing for an Allis-Chalmers "Electrifugal" pump. Bolts directly to motor yoke — eliminating extra parts, machined fits, misalignment problems.

ABRASION AND CHEMICAL REACTION are the major causes of casing wear. For if liquid is gritty, or contains foreign matter; or casing is not constructed of the right materials for the pumping service required — casing life is materially shortened. A minor cause of direct casing wear is misalignment.

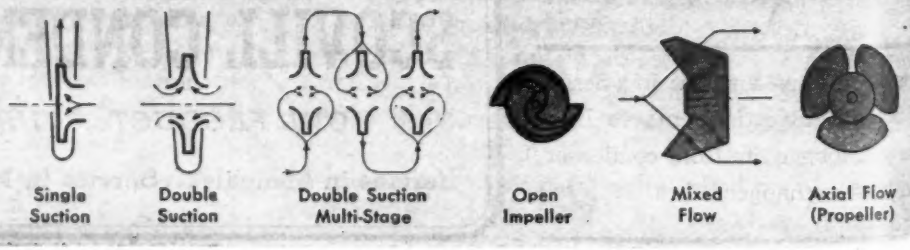
Original engineering of a pump can help prevent this wear. For example, Allis-Chalmers "Electrifugal" pump minimizes trouble from these sources in two ways: 1 — casings can be supplied in iron, bronze, stainless steel or other materials — depending upon type of service. 2 — It is a *unit-design* pump. Both impeller and motor are mounted on *one* shaft and in *one* frame. This means fewer parts, fewer fits — no chance for misalignment.

However, regardless of pump design, scheduled maintenance is still necessary if you expect to get longest wear from your casings. Some ways to do it . . .

- Check all piping supports regularly to see that they're effectively supporting the load.
- Every 6 months check piping itself to see whether it has shifted in any manner. Disconnect suction and discharge piping to see if it springs in any direction. Check the alignment of pump and motor — shimming up units as required.
- Once a year clean and inspect casing for wear, deposits or pitting. Make necessary repairs.
- If foreign matter is being sucked into pump, wearing casing unduly, provide the intake end of suction piping with a suitable screen.
- Send for your *free* copy of "Handbook for Wartime Care of Centrifugal Pumps". This valuable booklet applies to *all makes* of pumps; contains *no* advertising. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS. A 1755

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



Lifetime Service

with SPRINGFIELD

cast steel headers

Springfield water tube boilers are the only boilers with cast electric steel headers. Not a single case of pitting or corrosion has ever been reported in these headers! That is only one of the many advantages of this new design — check the other Springfield header features on the right.

Typical of the many "firsts" in Springfield design are: Staggered 4-tube grouping and small 3" diameter tubes, which assure high heat transfer efficiency; Across-Tube Baffles which reduce exit gas temperatures; Easy water level control — no variable steam space ahead of steam drum; Dry steam; High capacity close spaced Water Walls; Straight Tube design for easy maintenance, high reliability and safety with sectionalized construction.

Springfield boilers are available from 5000 to 500,000 lbs. per hour and higher capacity, and from 75 to 750 p.s.i. and higher. A Springfield is a modern, quick-steaming boiler, easy to operate and maintain, low in operating cost and high in operating efficiency. Contracts taken for complete steam generating units. Write today!

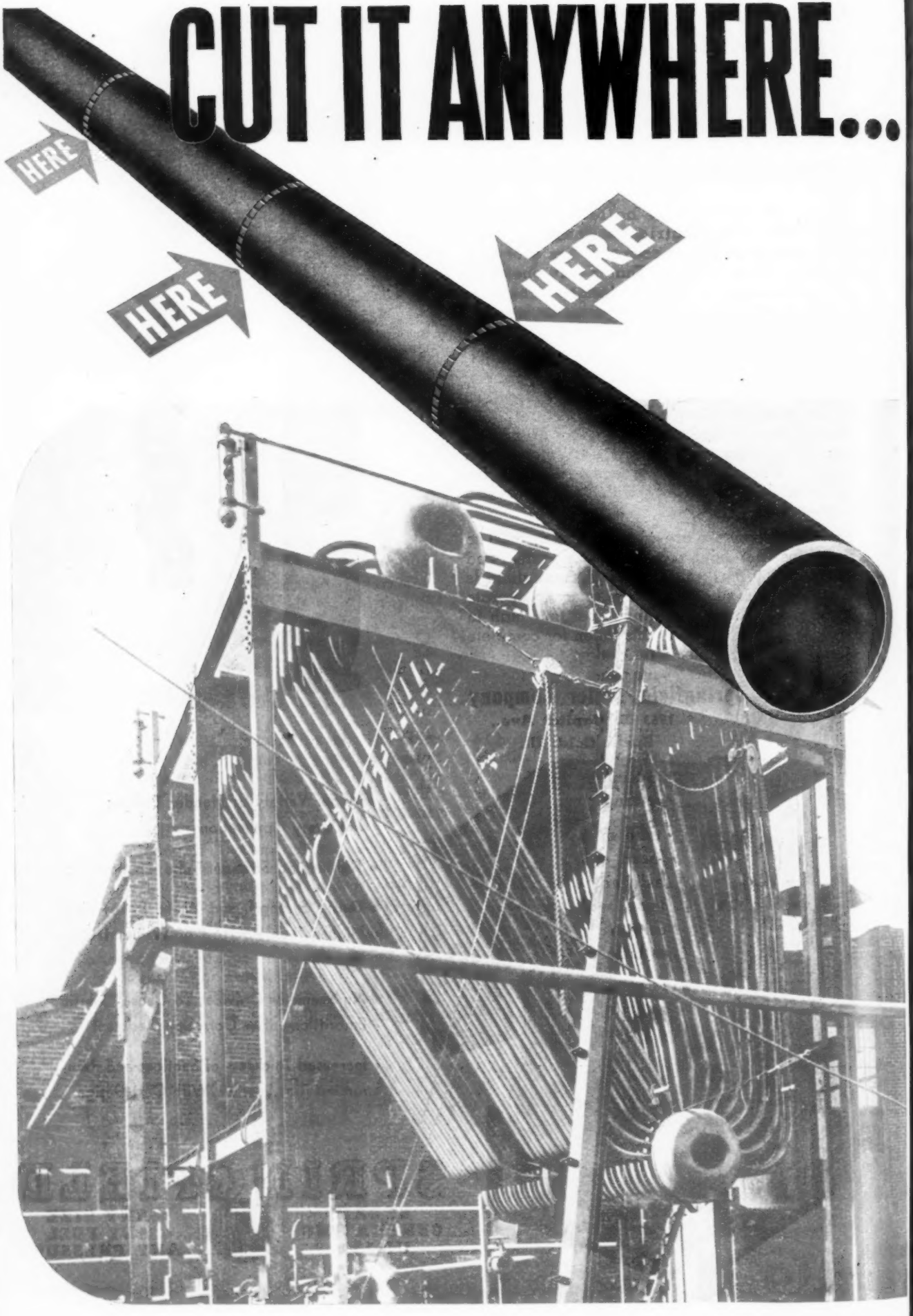
Springfield Boiler Company
1953 E. Capitol Ave.,
Springfield, Ill.

- Wider Variety of Header Designs For Every Application
- Tighter and Stronger Tube Connections
- Tensile Strength and Yield Point 25% Higher Than Forged or Wrought Construction
- No Seams or Crevices To Cause Caustic Embrittlement — Corrosion Resistant
- Increased Thickness of Sections and Reinforcing Ribs Possible With Cast Design.

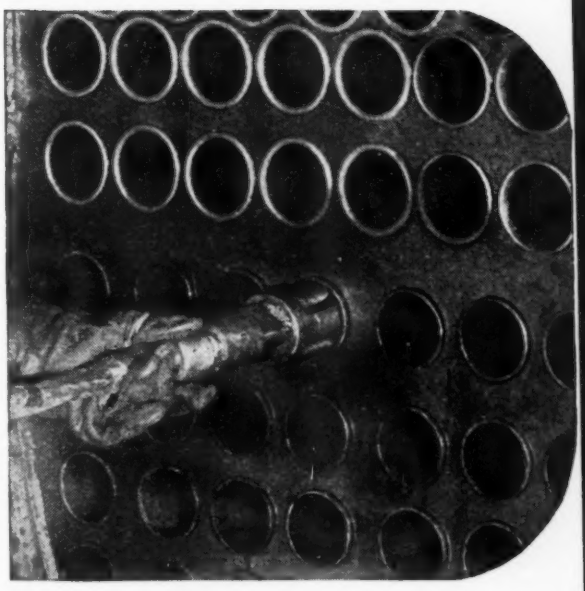
SPRINGFIELD

STEAM GENERATING UNITS

ANY SIZE ANY FUEL ANY PRESSURE


CUT IT ANYWHERE...
HERE
HERE
HERE

ELECTRUNITE BOILER TUBES



Always Roll in Easily

It's a fact—you can cut an ELECTRUNITE Boiler Tube at any point, and the cut ends will roll in just as easily as the original ends. Yet Republic's practice of full normalizing the *entire length* of *every* tube is just one of the features which save time and money for ELECTRUNITE users.

These *modern* tubes are consistently UNIFORM in diameter, wall thickness and concentricity—due to Republic's improved electric resistance welding process.

They slide through tube sheet holes freely, roller expand and bead over to smooth, non-leaking joints easily and quickly. Rare, indeed, is the occasion when "weepers" are found in pressure testing a completed ELECTRUNITE installation.

Every ELECTRUNITE tube must pass a rigid testing routine, both during and after fabrication—including hydrostatic testing at pressures in excess of code requirements—offering you positive assurance that each tube is uniformly sound and strong throughout.

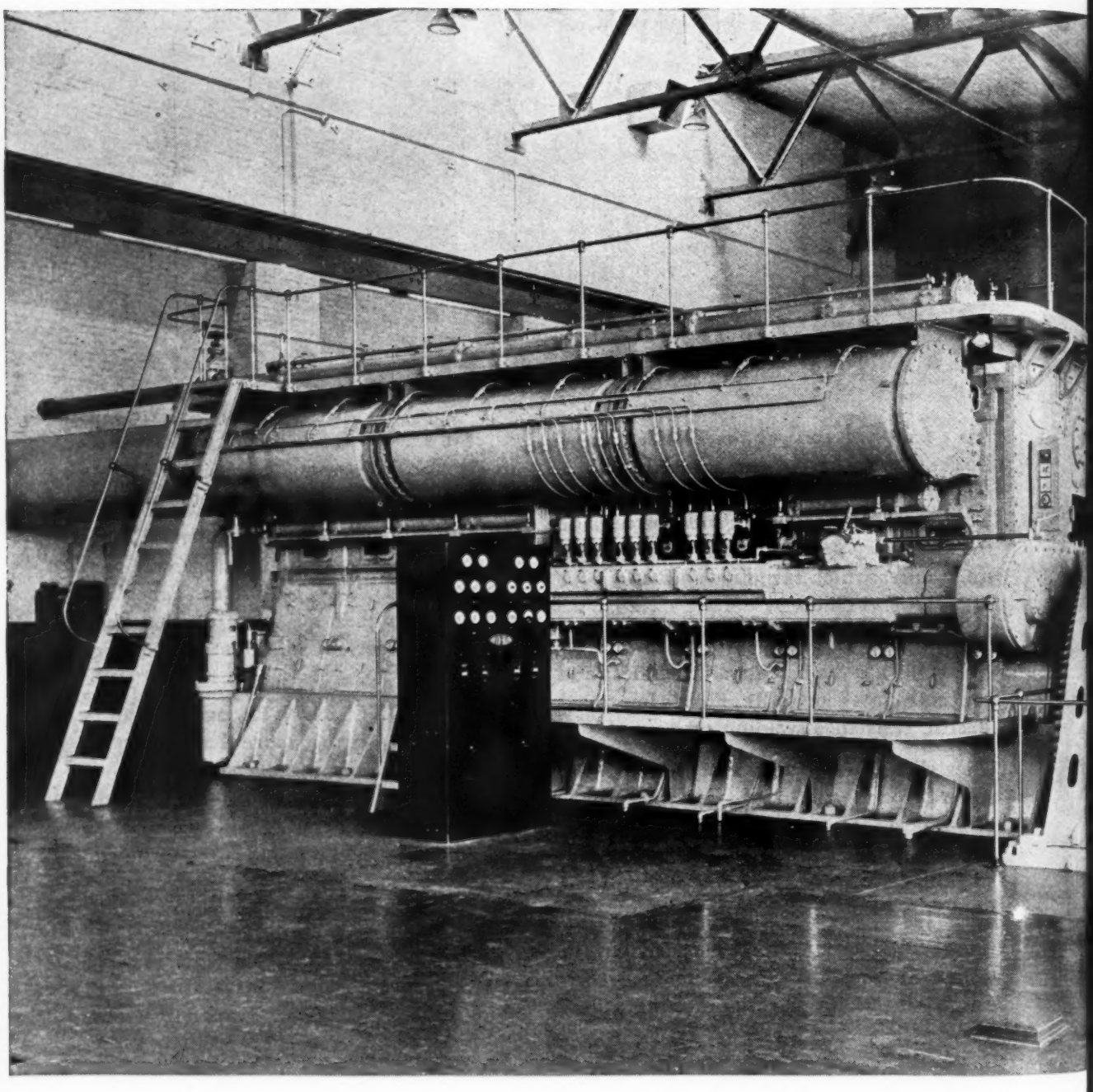
There's no need to worry about valve-clogging scale or corrosion-inviting scale pits, either. ELECTRUNITE Boiler Tubes are made from highest quality, flat-rolled steel, carefully inspected on both sides before processing.

Proof of ELECTRUNITE acceptance is found in the fact that more than 150,000,000 feet have been installed in all types of stationary, railroad and marine boilers, and in other steam generating and heat transfer equipment throughout industry. Write for the new brochure on boiler, heat exchanger and condenser tubes.

REPUBLIC STEEL CORPORATION
STEEL AND TUBE DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

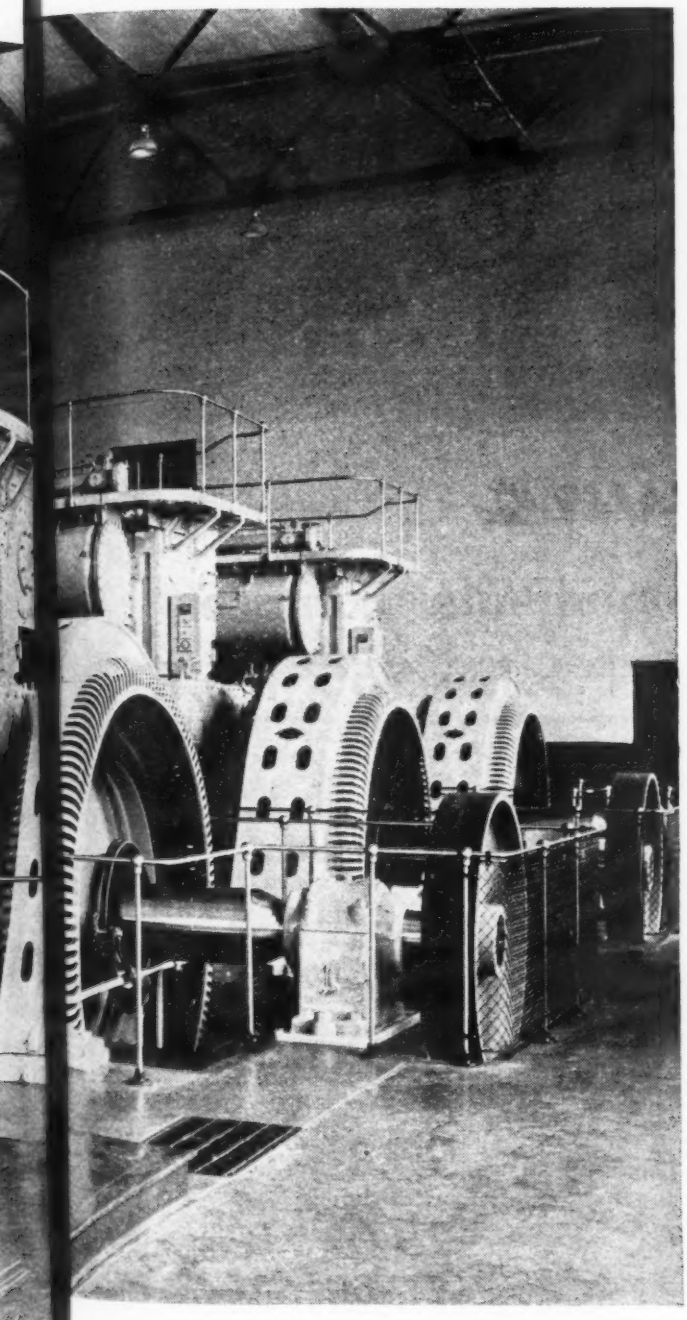
Keeping Diesels



TEXACO

TUNE IN THE
TEXACO STAR THEATRE
WITH JAMES MELTON
EVERY SUNDAY NIGHT—CBS

on the Line



TODAY, more than ever, maintenance-wise Diesel operators are relying on effective lubrication to eliminate scuffing, ring-sticking, corrosion, sludge formation and other conditions that cut performance efficiency and increase "down time" for service and repairs.

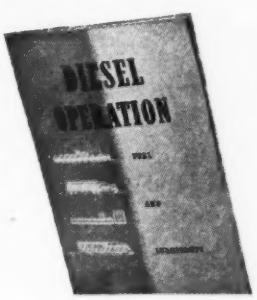
Everywhere, the operators of large stationary installations, mobile units and Diesels in marine service know that effective lubrication is a certainty when they use Texaco Ursa Diesel lubricants.

Texaco Ursa Diesel lubricants are available in a complete line to meet the lubrication needs of every type of Diesel. They have provided, in countless installations, more efficient Diesel operation, reduced service and maintenance costs. Their use increases life of rings, pistons, liners and bearings. Because of these benefits—

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

A Texaco Lubrication Engineer, specializing in Diesel lubrication, will gladly recommend the most suitable type and grade of Texaco Ursa Diesel lubricant for your engine. Phone the nearest of more than 2300 Texaco distributing plants in the 48 States, or write

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



NEW EDITION now ready! This popular, 112-page book of Diesel facts and figures has been fully revised and brought completely up to date with much new material. "Diesel Operation" is practical, helpful, fully illustrated. Write for your copy today!

Lubricants and Fuels

FOR ALL DIESEL ENGINES

Availability Record of NEW DESIGN TWIN FURNACE Steam Generators

FOUR UNITS

with Separately Fired Superheater Furnaces

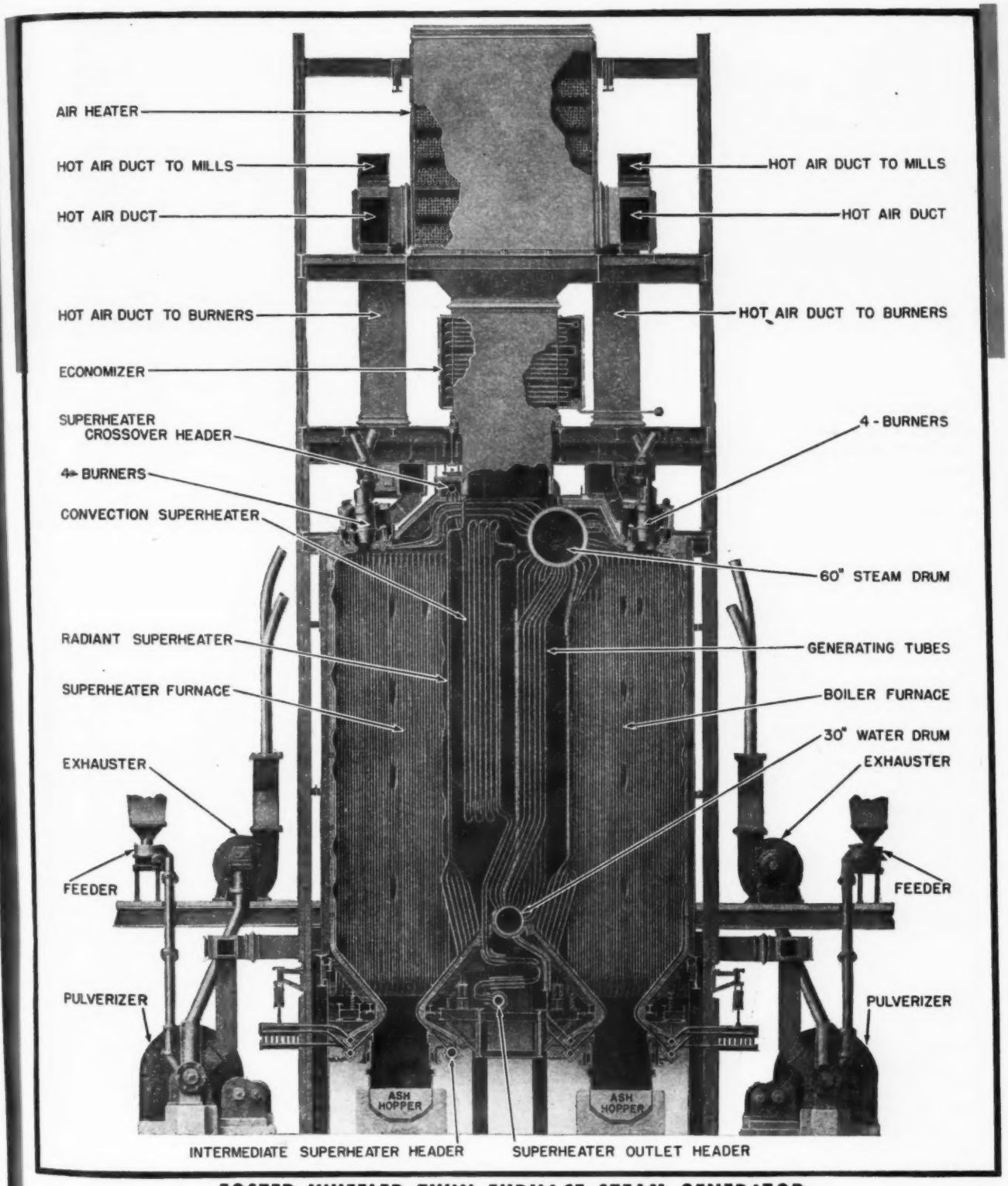
450,000 LB. per Hr. – 1550 P. S. I. – 950° F. S. T.

96.1% AVERAGE AVAILABILITY

NO.	STARTING MONTH	AVAILABILITY
1	January 1943	96.0*
2	February 1943	96.6*
3	May . . . 1943	95.8*
4	June . . . 1943	96.0*

*Including outages to make necessary changes and adjustments to perfect a new design.

FOSTER WHEELER CORPORATION



FOSTER WHEELER TWIN FURNACE STEAM GENERATOR

165 Broadway — New York 6, N. Y.

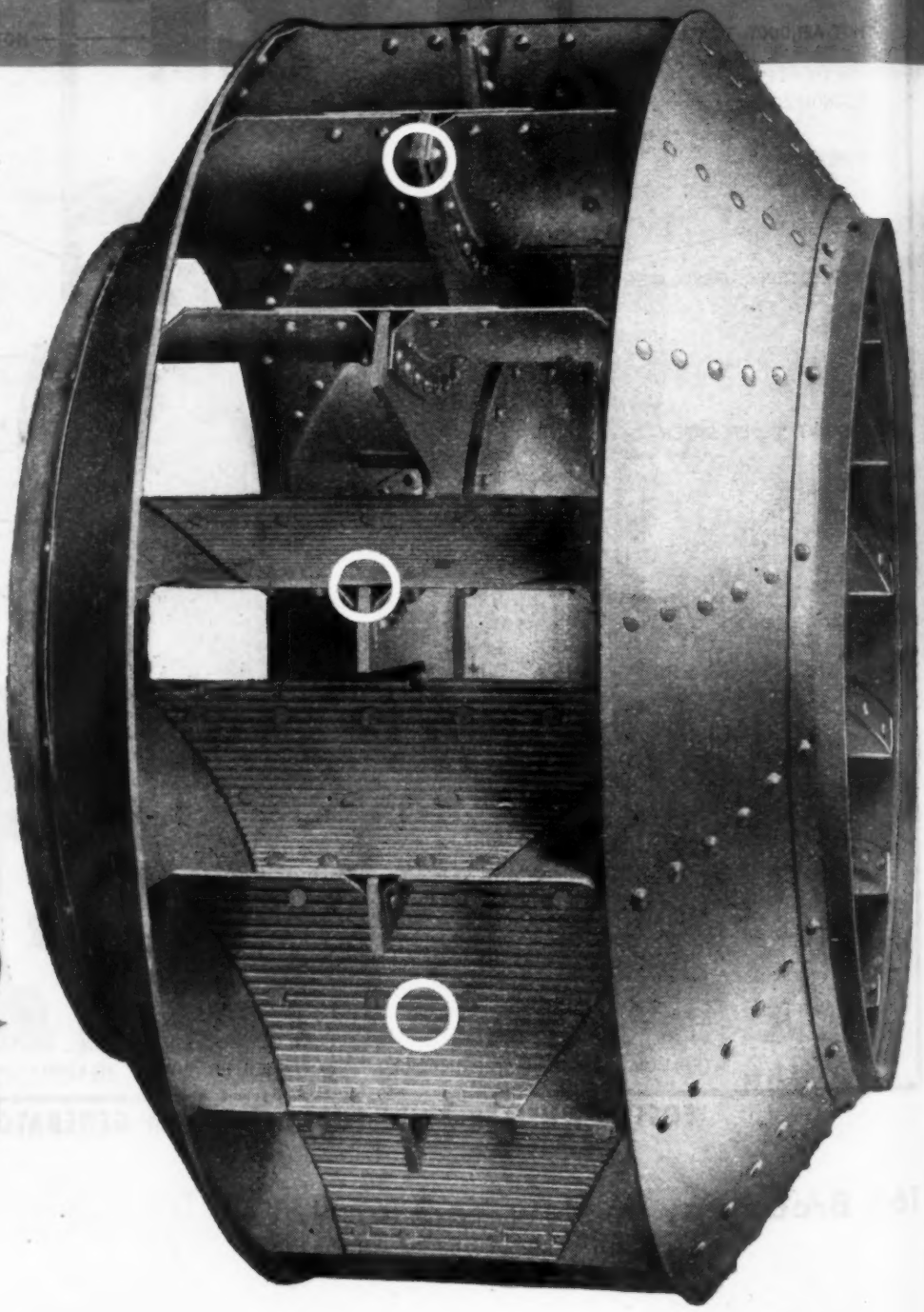
MAKE FLY ASH ATTACK ITSELF

with a Sturtevant Erosion Resisting Wheel

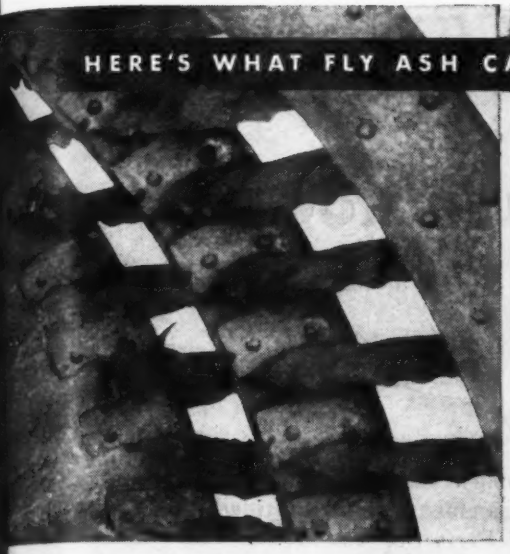
1. Concentrated streams of fly ash from both inlets impinge against each other—because *center plate is cut away* between blades.

2. Flow of fly ash is smooth and unobstructed—because *blades are continuous* and not divided by a center plate.

3. Where fly ash concentration is greatest, *special ribbed liners* protect the alloy steel blades. Liners are easily renewed when necessary.



HERE'S WHAT FLY ASH CAN DO TO A WHEEL

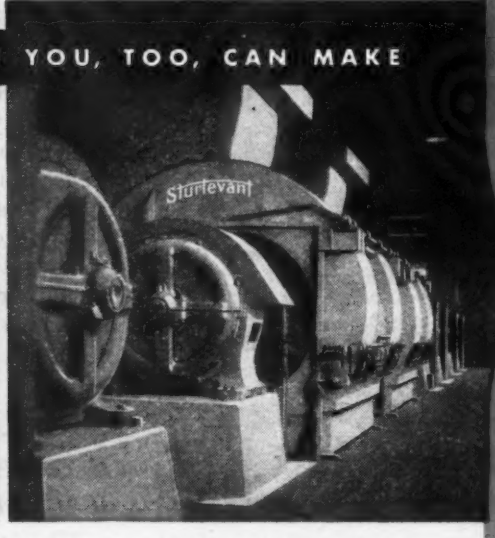


The large number of blades in a fan wheel of this type are especially susceptable to erosion under today's high speed and pressure requirements.

With centerplate construction erosion generally occurs at the junction of floats and centerplate.

HERE ARE SERVICE RECORDS YOU, TOO, CAN MAKE

Burning 700 tons of coal per day (9% ash content), Sturtevant Erosion Resisting Wheels—in service 3½ years—show little sign of wear, no loss in efficiency.



Normal life of induced draft fan wheels was about one year—yet Sturtevant Erosion Resisting Wheels have been on the job 2½ years—no replacements necessary.

AIR CONDITIONING

DRYING

HEATING

VENTILATING

MECHANICAL DRAFT

DUST AND FUME CONTROL

Foundrymen learned how abrasive fly ash can be when they used it to clean castings. But power plants learn about fly ash the hard way—when it knocks out their induced draft fans. That's why Sturtevant designed this special erosion resisting wheel to make *fly ash attack itself*. Notice cut-away Centerplate and that tie rods are eliminated. Blades have been reduced to 48 or less—shaped to minimize abrasive action and *armored* against it!

This Sturtevant achievement in fan engineering is now installed in many outstanding plants. Under severe fly ash conditions, these wheels have twice or more the length of life of standard designs. When wear does occur, it is only necessary to replace the liners—no loss in efficiency after two and three years service. If your induced draft fans are paying the toll of severe wartime operating conditions, it will pay you to investigate this well-proved way of combating fly ash—the Sturtevant Erosion Resisting Wheel.

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.

"CROSS FIRING"

GIVES BETTER AIR DISTRIBUTION

The dumping grate bars of the Æ Perfect Spread Stoker are uniquely designed with "staggered" non-clogging ports to provide a steady cross flow of air that uniformly blankets the entire grate area. This assures a rapid and complete mixture of fuel and air, and a uniform burning rate at all times. In addition, the bars are thoroughly air-swept from below for proper cooling.

END BOILER ROOM DRUDGERY

DIRTY, tiresome jobs with hand stoking that make boiler room operations wasteful and distasteful are virtually ended when you install an Æ Perfect Spread Stoker. You'll marvel at the elimination of these inefficiencies and the way steam and operating costs drop.

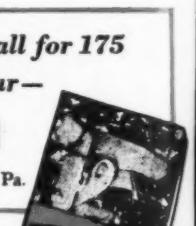
Fully automatic and simple in operation, this modern, streamlined stoker requires practically no attention. It runs steadily, quietly—regardless of the steam demands—without clogging or jamming. It keeps the boiler room neat and clean and makes grate cleaning and ash removal surprisingly easy.

When you consider all these advantages, as well as its ability to burn economically the widest range of solid fuels, you'll see how the Æ Perfect Spread Stoker keeps labor requirements low and makes waste go. You can get all the facts by writing today for the eye-opening Æ bulletin on low cost steam production.

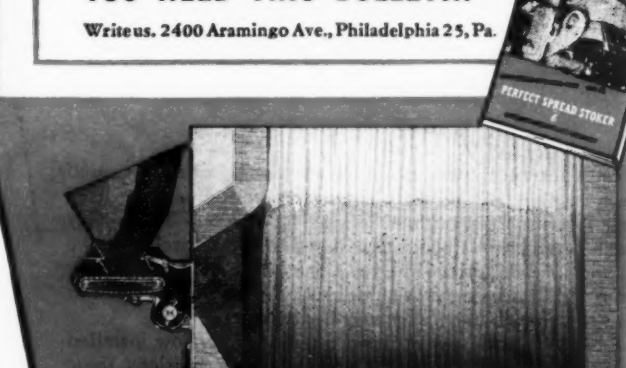
If Your Steam Requirements Call for 175 H. P. up to 200,000 lbs. per hour—

YOU NEED THIS BULLETIN

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.



Æ PERFECT SPREAD STOKER



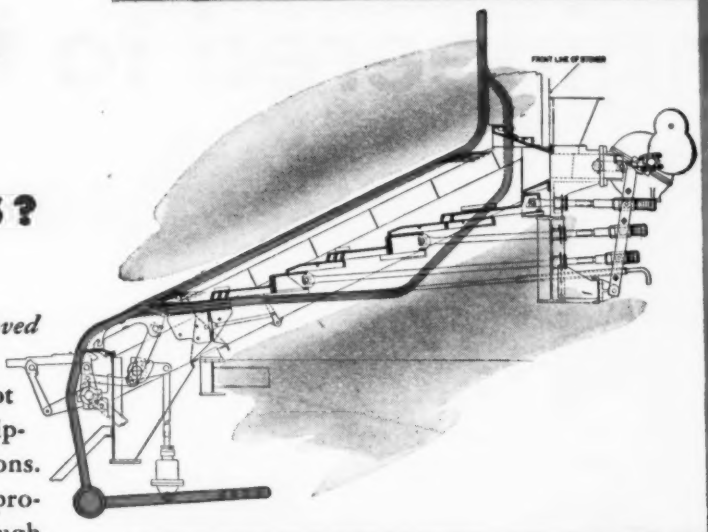
Other Æ Products: Æ-Taylor Stokers, Lo-Bed Hoists, Modern Deck Architecture, Axle-Flow Fluid Power, Diamond Fuse Grinders

AMERICAN ENGINEERING COMPANY

Subsidiaries: COCHRANE CORPORATION, Philadelphia, FARADAY ELECTRIC CORPORATION, Adrian, Mich.

PHILADELPHIA 25, PENNSYLVANIA

WILL THIS STOKER AFFECT YOUR FUTURE OPERATIONS?



PERHAPS you've heard about the *improved* Taylor Stoker—a time-tested stoker with outstanding *new* features that you should not overlook when selecting fuel firing equipment for your future power plant operations.

Precision control feed mechanism and provisions for better air flow mean more thorough combustion and minimum stack discharge. The stoker has simplified unit construction throughout with fewer moving, longer wearing parts. Continuous ash discharge and numerous other advantages are additional aids to efficient operation and low cost steam generation.

Examine *all* these features in the Type "R" Taylor Stoker booklet before you make *any* decision. A few minutes invested this way will pay dividends in worthwhile information. Mail your request to us *today.*

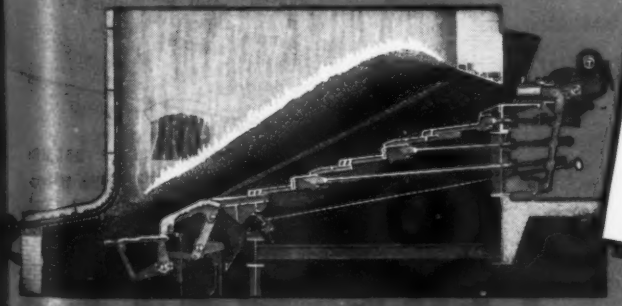
TYPE "R" WATER-COOLED TAYLOR STOKER has Important Operating and Maintenance Advantages

The Taylor Stoker is available with integral water tubes connected into the boiler circulation. This feature assures maximum fuel flexibility, higher operating efficiency and low boiler outage.

IF YOUR Steam Requirements Call for 20,000 to 500,000 lbs. per hour—

YOU NEED THIS BOOKLET

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.



Æ TAYLOR STOKERS

AIR-COOLED & WATER-COOLED

Other Æ Products: Æ-Perfect Spreal Stoker, Le-Hed Boilers, Marine Deck Auxiliaries, Hele-Shaw Fluid Power, Diamond Face Grinders

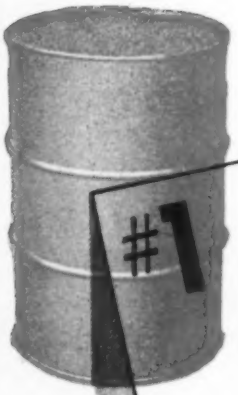
AMERICAN ENGINEERING COMPANY

Subsidiaries: COCHRANE CORPORATION, Philadelphia, FARADAY ELECTRIC CORPORATION, Adrian, Mich.

PHILADELPHIA 25, PENNSYLVANIA

Copyright 1945, American Engineering Co.

Engineered to inhibit rust..



#1 TYCOL RIO TURBINE LIGHT

Engineered and recommended for:

1. **Stationary Turbines**
   (a) Bearings on direct connected bearing circulating systems.
   (b) Bearings on geared turbines with separate bearing and gear systems.
2. **Marine Turbines**
   (a) Bearings on geared turbines with two independent bearing and gear circulating systems.
   (b) Turbine and Generator bearings on Turbine-electric Drive with circulating system.
3. **Ring Oiled Bearings (Direct or geared, land or marine)**
   (a) Bearings at low temperature, below 140°F.

#2 TYCOL RIO TURBINE MEDIUM

Engineered and recommended for:

1. **Stationary Turbines**
   (a) Geared turbines with unit bearing and gear circulating system.
   (b) Gears on geared turbines with separate bearing and gear system.
2. **Marine Turbines**
   (a) All bearings direct connected with circulating system.
   (b) High Speed Single Reduction Gears on geared turbines with unit bearing and gear circulating system.
   (c) Single Reduction Gears or Primary Gears of Double Reduction on geared turbines with two independent bearing and gear circulating systems.
   (d) Propeller motor bearings with circulating or ring oiling system on Turbine-electric Drive.

* **CORROSION**
(RUST)

Have you received your copy of "Lubricania"?

This informative handbook, "Tide Water Associated Lubricania", gives a clear, concise description of the basic tests used to determine important lubricant properties — Corrosion, Flash Point, Pour Point and many others. For your FREE copy write to: Tide Water Associated Oil Co., 17 Battery Pl., New York 4, N. Y.

DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned promptly.

TIDE WATER

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL
Eastern Division:
17 Battery Place, New York 4, N. Y.

..oxidation

3 NEW TYCOL RIO TURBINE OILS

#3

TYCOL RIO 310

Engineered and recommended for:

1. Marine Turbines
   (a) Low speed double reduction gears on geared turbines with unit bearing and gear circulating system.
   (b) Double reduction gears on geared turbines with two independent bearing and gear circulating systems.
   (c) Turbine-electric Drive bearings on geared motor drive with circulating system.
2. Ring Oiled Bearings (Direct or geared, land or marine)
   (a) Bearings at normal temperatures, between 140° and 180° F.

These new Tycol RIO oils are an extremely valuable contribution to satisfactory turbine performance. Their remarkable purity of refinement – their endurance in service – and their high rust and oxidation inhibiting qualities is a matter of record.

Long and exhaustive tests in actual turbine units – units already showing definite rust development when operated on conventional type oils – prove the efficiency of RIO oils . . . both as an economical lubricant, and rust inhibitor.

Therefore, if moisture is a factor in your turbine operations, you can depend on RIO oils, with their high rust inhibiting properties, to provide unqualified protection against corrosion . . . without loss of valuable lubrication efficiency.

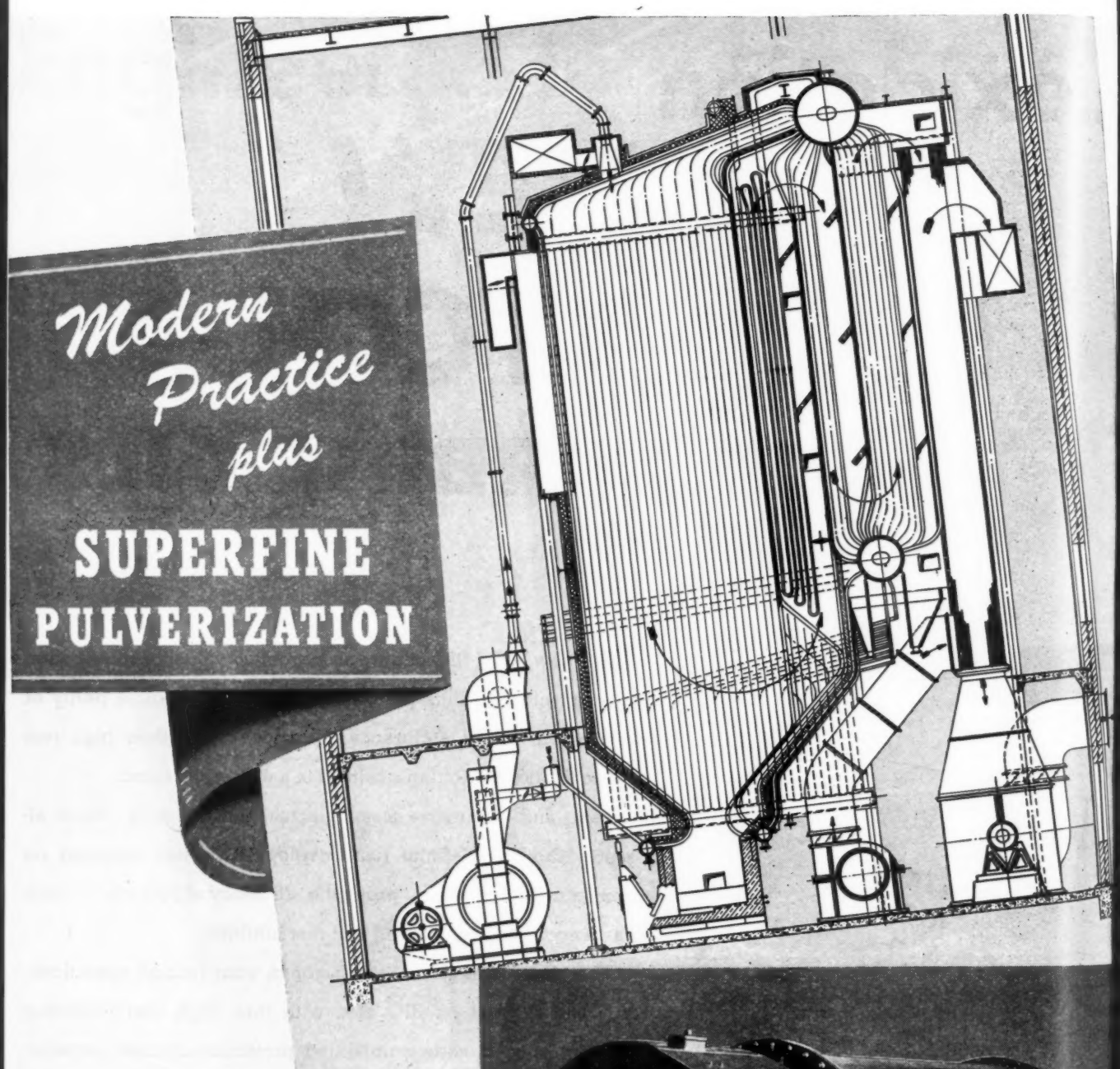
Tide Water engineers are thoroughly experienced in all phases of turbine lubrication. Call or write the nearest Tide Water Associated office for expert advice and help in selecting the Tycol lubricant best suited to your specific need.

TYCOL

ASSOCIATED OIL COMPANY

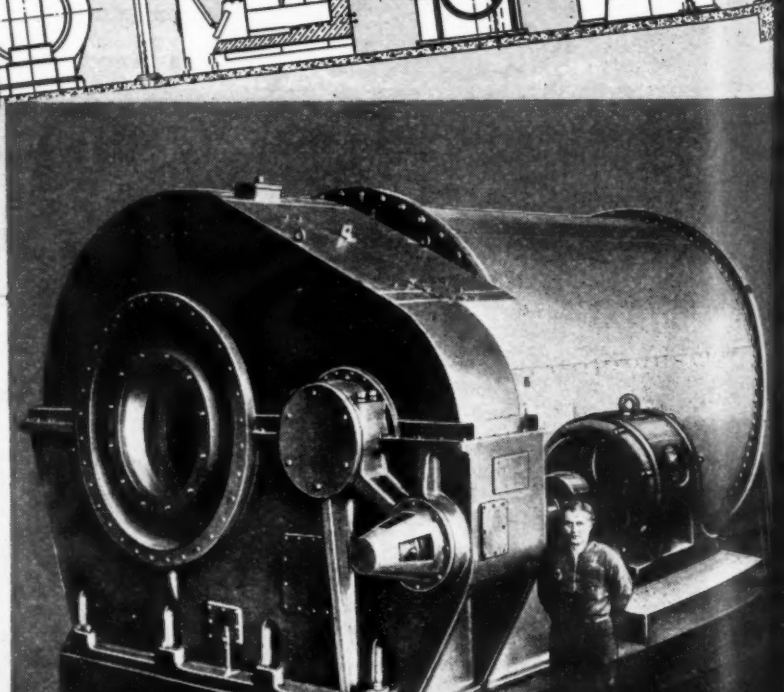
Principal Branch Offices:

Boston • Philadelphia • Pittsburgh • Charlotte, N. C.



Modern Practice plus

SUPERFINE PULVERIZATION



THE Kennedy Air-Swept Tube Mill will pulverize all grade coals at low cost for power and maintenance. It is unaffected by tramp iron, or coals of low grindability. Because of the rapid drying effect achieved, the KVS Pulverizer will handle coal having a high moisture content. Continuous fine grinding with 85 to 95% through 200 mesh and 70% through 300 mesh is demonstrated in actual practice.

KVS PROVIDES ALL ESSENTIALS

in design and equipment . . .

TO MEET *the* NEED *for* LOW COST STEAM

The steam generating unit illustrated here . . . one of many KVS designs . . . typifies the pioneering that is behind KVS engineering, because it takes into consideration those factors which must be considered if low-cost steam generation is to be the objective in the power plants of the future.

For example:

. . due consideration has been given to furnace design to permit proportioning which places no restrictions on coal selection.

. . unit firing is provided to assure maximum flexibility in control, regardless of load fluctuations.

. . accurate control of steam temperatures is provided for.

. . coal pulverization, with the KVS Air-Swept Tube Mill, is superfine, which when thoroughly mixed with air and air-floated to burner becomes a carbureted fuel approaching the gaseous state for faster, truer, more perfect combustion.

Steam generating units of the type shown have been designed and built by KVS for any capacities, pressures or steam temperatures, and for operation on any coal.

KVS EQUIPMENT

Boilers—Air-Swept Tube Mill Pulverizers—Fans—Air Preheaters—Superheaters—Economizers—Water Walls—Coal Elevators—Bunkers—Coal-Weighing Scales—Ash Conveyors

KVS ENGINEERING

Kennedy-Van Saun offers a complete service for the design, building, erecting and furnishing complete, ready-to-operate steam generating plants including all necessary components. This service is available under one responsibility. KVS Engineers will give your steam requirements careful attention.

Kennedy Products — Quality · Service — New York USA

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

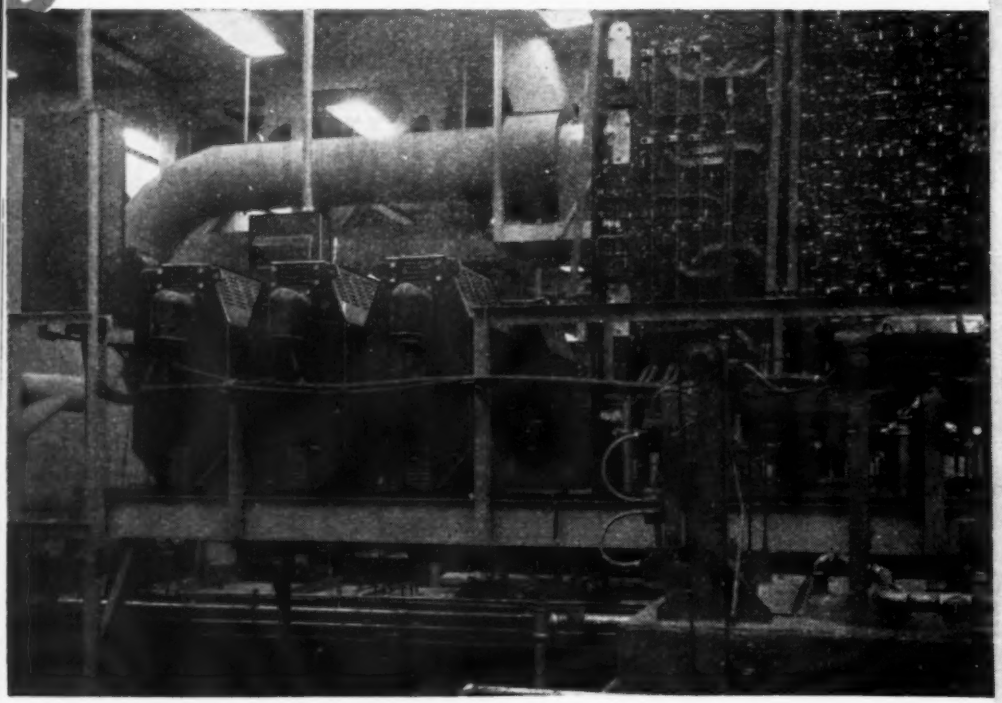
FACTORIES:

DANVILLE, PA., U. S. A.

CANADA, ENGLAND, AUSTRALIA

ARMY E NAVY

6 THINGS TO NOTICE in this picture



1. The dry-type transformers are close to the load, yet out of the way.
2. There are no long runs of heavy copper.
3. No expensive, space-stealing fireproof vaults are required.
4. The transformers are totally metal enclosed for safety.
5. Little installation space is used.
6. The slanted-louver construction, top and bottom, to assure cool operation. (The "chimney effect" produced by this construction carries away heat rapidly.)

THEY'RE ALL ADVANTAGES YOU CAN HAVE WITH

G-E TYPE D TRANSFORMERS

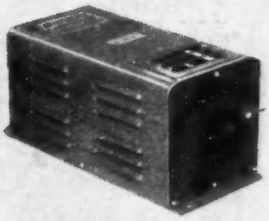
DO YOU REALIZE the many jobs on which you can use small G-E dry-type transformers to advantage? Insulating lighting circuits from power circuits, boosting low line voltage, and supplying the right voltage for the most economical operation of motors, machine tools, and welding apparatus are only a few of their many money-saving applications.

Stay cool; save space—Type D transformers are cooled by natural-draft ventilation. Their unique case construction aids the flow of ventilating air through the transformer coils. They can be installed against a wall or close to other units with little or no effect on the temperature rise of the transformer. Because of this fact, considerable space can be saved, especially when a number of these transformers are to be banked. (For example, the above installation in a midwestern plant. Here, only a small platform is required to take care of six 100-kva units to supply 230-volt annealing furnaces.)

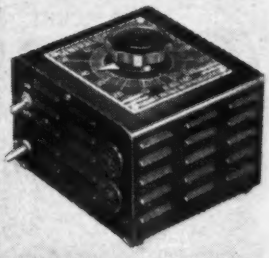
Easy to install; maintenance negligible—As these transformers are small, compact, and lightweight, and do not require a fireproof vault, they can be installed almost anywhere you wish. The ease of disassembly and reassembly of case parts permits quick inspection and cleaning, when necessary. Operating records show that little or no maintenance is required.

Type D transformers are available in ratings up to and including 100 kva—600 volts and below. For further information, ask for Bulletin GEA-897. *General Electric Company, Schenectady 5, N. Y.*

OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



VARIABLE-VOLTAGE AUTO-TRANSFORMER — Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.

AIR-COOLED REGULATORS—Automatic type: for secondary circuits (10% regulation, raise and lower). Remote-motor or hand operated: for laboratory or testing (100% raise and lower). Ratings up to 12 kva, 600 volts.

THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB **BETTER**

GENERAL ELECTRIC

403-80-5205, 5400

WHAT JOBS DO YOU HAVE FOR THIS NEW TYPE PACKING?

Can you use a packing that's resilient enough to absorb vibration between stationary and moving parts... thermally durable enough to stand temperatures up to 2000°F.... and inert enough to resist corrosion by gases, alkalies and most acids?

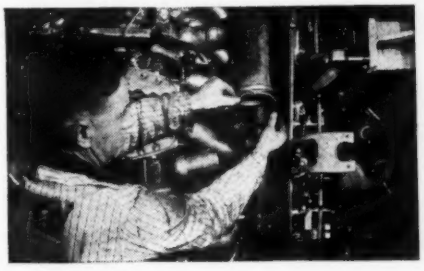
If the answer is "Yes," you'll be interested in the packing illustrated.

Its development began when an improved seal was needed in the exhaust line joints of Uncle Sam's airplanes.

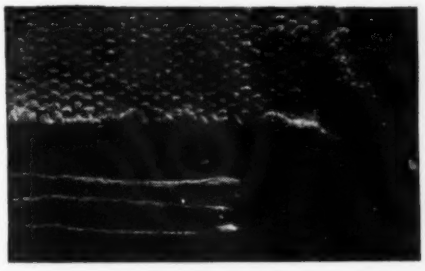
Corrosive, flaming, exhaust gases quickly char ordinary organic substances. And, materials that can endure the heat, soon disintegrate under incessant vibration.

But Johns-Manville engineers found a way to lick the problem. They had thin strands of Inconel knitted into mesh. Inconel was chosen because it offered unmatched thermal endurance plus the required resistance to both vibration fatigue and corrosion. Then, they braided the mesh with an asbestos sealing core and compressed it to the desired shape and size. Result: a resilient *packing that doesn't shake to pieces—nor wilt under high heat.*

Now, to find how the packing problem you have in mind can be worked out with this new type packing... just turn the question over to Johns-Manville Corp., 22 East 40th St., New York 16, N.Y.



INCONEL MESH-ASBESTOS PACKING *being installed in an exhaust line joint of a Superfortress. Produced by Johns-Manville, this type packing is available as strip, half-round or square cross-sections in standard and special sizes. Also made of Monel or pure nickel. (Photo courtesy of Boeing Aircraft Company)*



Another Possible Aid in Power Plants!

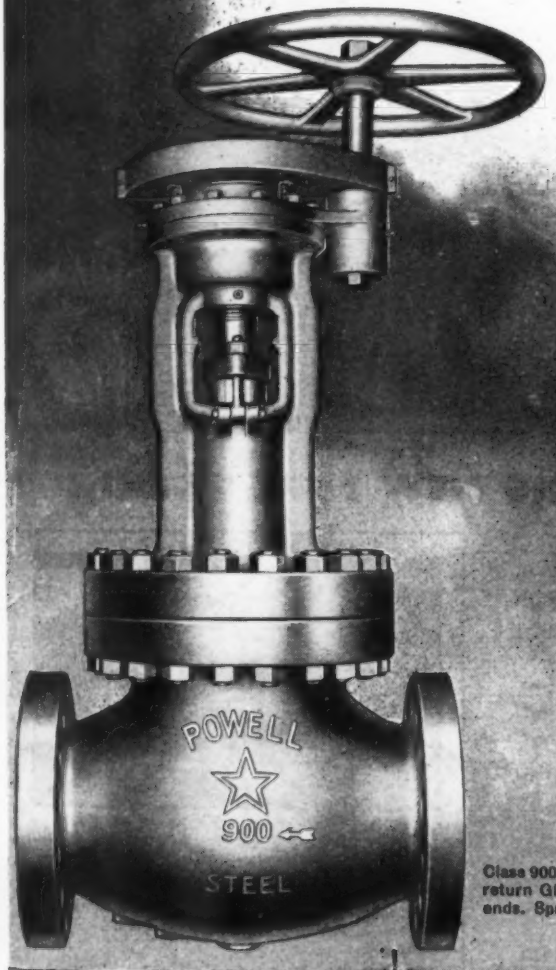
CLOSE-UP SHOWS MONEL-ASBESTOS CLOTH *also devised by Johns-Manville. Used to insulate marine turbines. Each thread consists of fine Monel wires, twisted with asbestos yarn. Monel withstands corrosive sea air... pounding vibration... temperatures up to 850°F.*

THE INTERNATIONAL NICKEL COMPANY, INC. • 67 Wall St., New York 5, N.Y.

NICKEL INCO **ALLOYS**

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL • Sheet... Strip... Rod... Tubing... Wire... Castings... Welding Rods (Gas & Electric)

Powell Valves
comin' through



Class 900-pound Cast Steel Non-return Globe Valve with flanged ends. Spur gear operated.

Every day thousands of valves of all types, designs and materials are "comin' through" the various stages that make the name "Powell" on a valve the hallmark of quality. Into every step—from perfect casting to final merciless testing—goes the KNOW-HOW of 99 years of concentration on making valves—and valves only—for industry.

When they are finally pronounced worthy in every detail to bear the Powell name, they go out to join the hundreds of thousands of their family who are "comin' through" with flying colors under all kinds of service conditions in every branch of American industry.

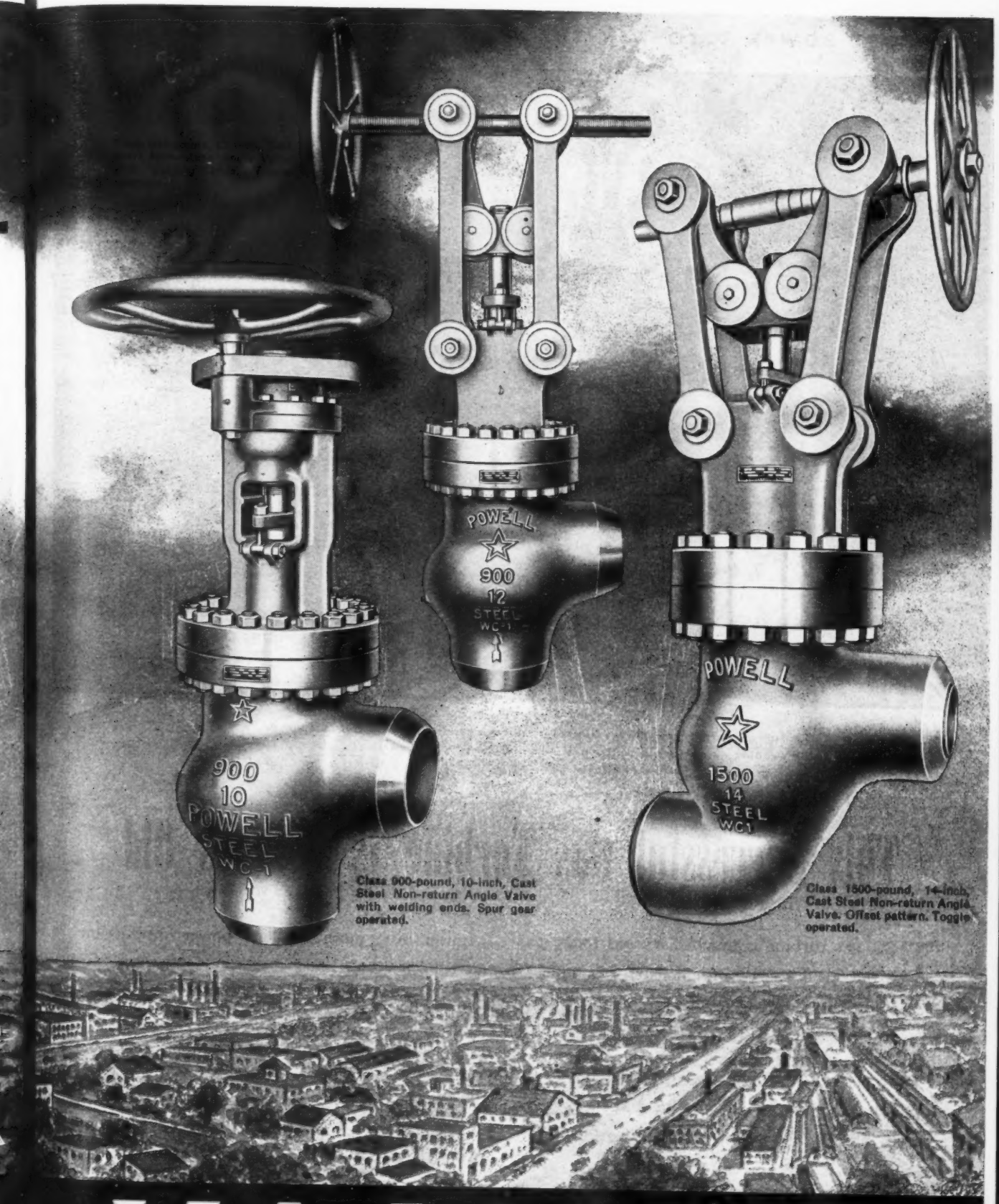
The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati 22, Ohio

Powell Non-return Globe and Angle Valves are scientifically designed and engineered, with streamline bodies that provide maximum flow area with minimum pressure drop. They can be supplied in various sizes for all pressure classes from 300 pounds to 2500 pounds, inclusive.

POWELL



Class 900-pound, 10-inch, Cast Steel Non-return Angle Valve with welding ends. Spur gear operated.

Class 1500-pound, 14-inch, Cast Steel Non-return Angle Valve. Offset pattern. Toggle operated.

VALVES

LOW COST POWER...TO WIN THE WAR NOW...AND THEN THE PEACE

Gas turbine (turbo-supercharger) used on Cooper-Bessemer marine and locomotive diesels. Hot exhaust gases drive a centrifugal compressor which compresses fresh air, forcing it into the power cylinders to supply extra oxygen for the combustion of additional fuel.

This Successful Gas Turbine Is 9 Years Old

THE gas turbine is much discussed today as a potential source of efficient, economical power for the locomotives, aircraft, boats and power plants of the future.

Here is a gas turbine, designed and built for super-charging marine, locomotive and stationary diesels. For eight years, it has been working successfully on Cooper-Bessemer engines.

Known as a turbo-supercharger, its operation is readily understood from the diagram above. Turbo-charging increases the horsepower of a diesel up to 50% without adding to engine weight.

Lower-cost, more efficient power production has been a major objective of this Company for 112 years. When you order your Cooper-Bessemer diesel, gas engine or compressor, you can be confident that it represents the utmost in dependability, efficiency, economy, for a long life.

THE **Cooper-Bessemer** CORPORATION
Mt. Vernon, Ohio • Grove City, Pa.

BUILDERS OF DEPENDABLE ENGINES FOR 112 YEARS

ANOTHER FIRST IN ENGINE DEVELOPMENT

THE COOPER-BESSEMER SUPERCHARGED GAS ENGINE

COMPLETE, unqualified success in supercharging an engine operating on gaseous fuel is announced by Cooper-Bessemer.

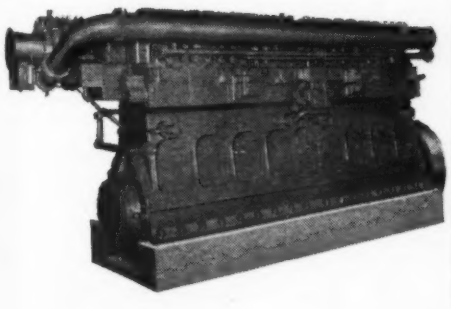
This provides:

An increase in horsepower of 40 to 50 percent, with no appreciable increase in engine weight or space.

Supercharging is made possible and practical by a simple, *patented* means of timing the admission of gas, which permits complete scavenging, under pressure, without fuel loss.

The advantages of this revolutionary development are not limited to future installations. All Cooper-Bessemer supercharged diesels now in service can be converted readily to gas fuel operation, or to operation on any combination of gas and oil fuel.

The nearest Cooper-Bessemer office will gladly furnish any additional information you might require on the profitable application of this development to your present or future needs.

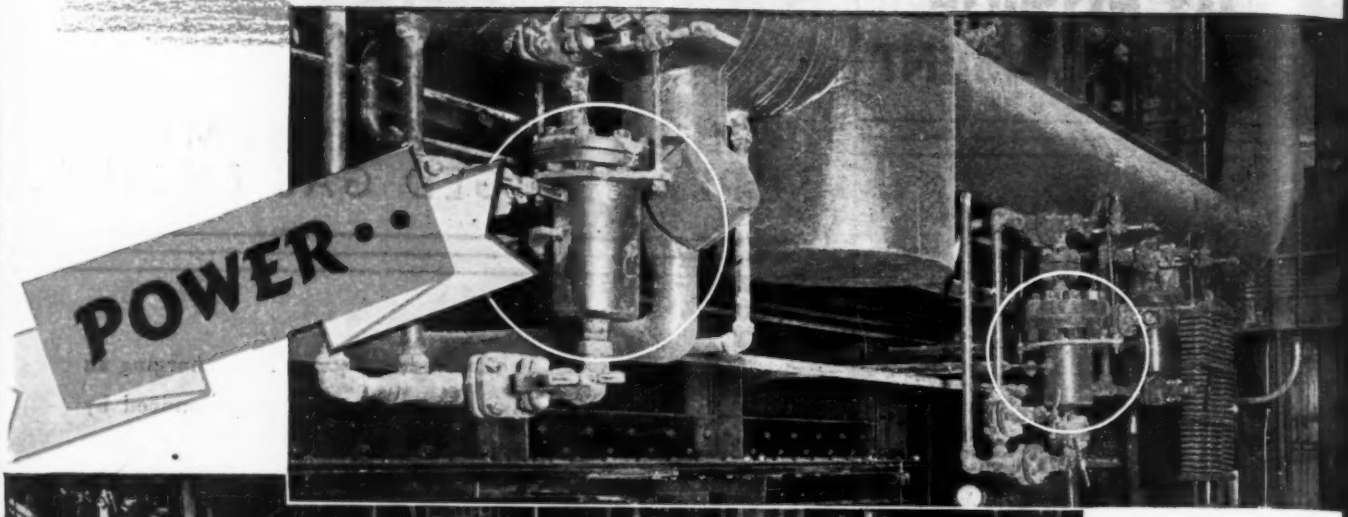


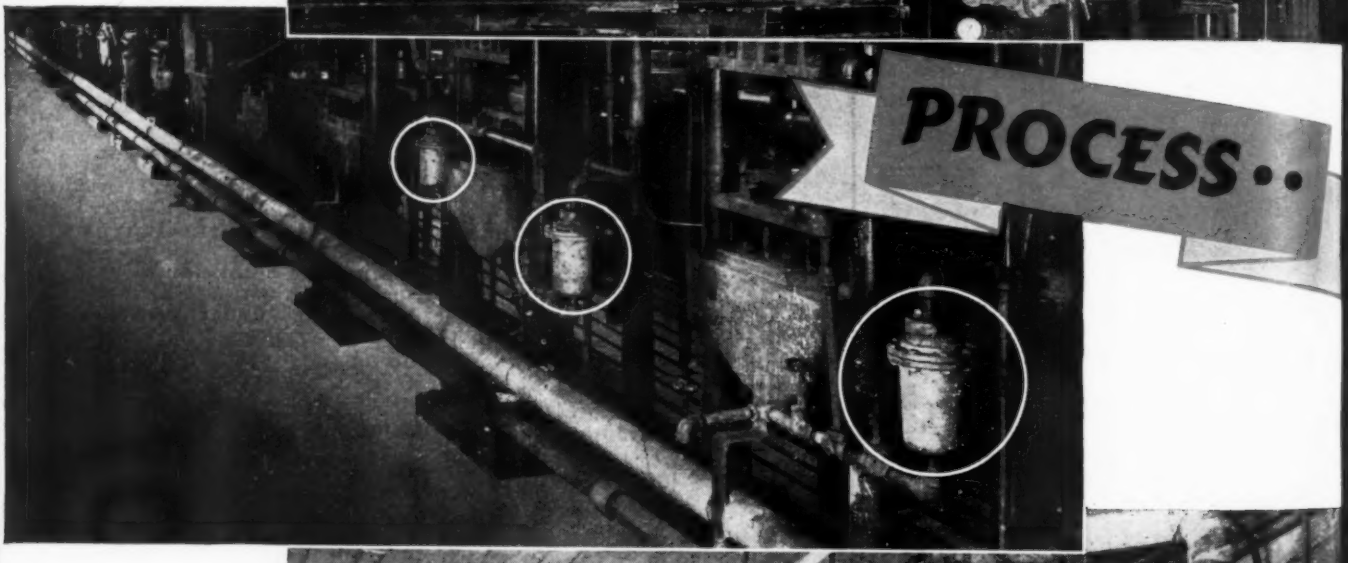
THE COOPER-BESSEMER CORPORATION
Mount Vernon, Ohio Grove City, Pa.

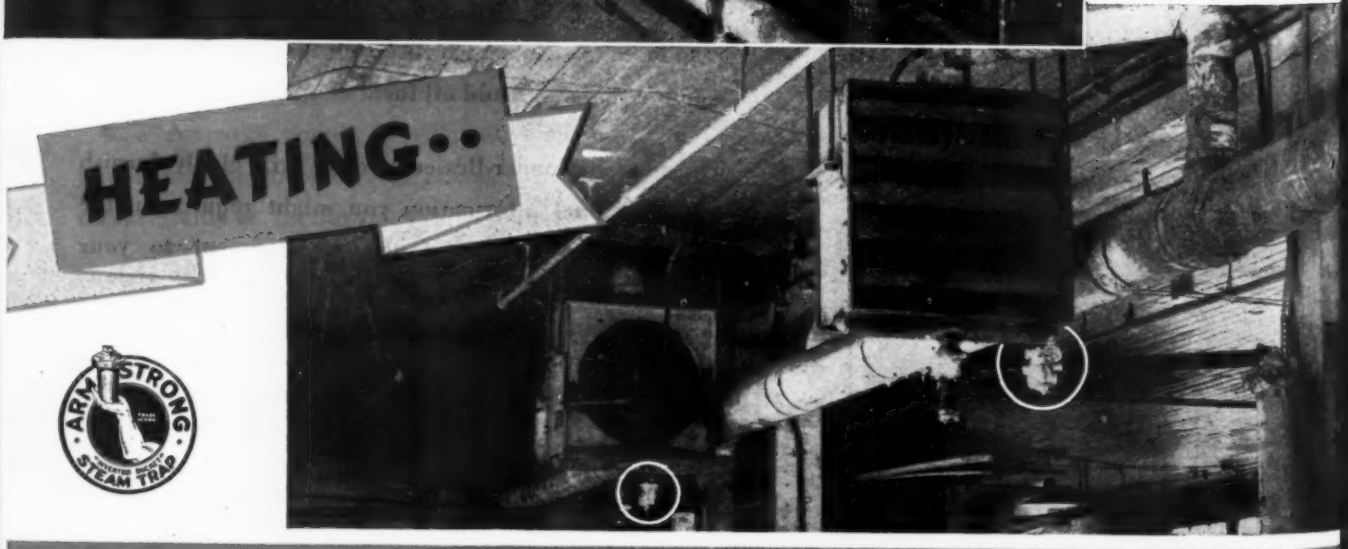
New York Washington Houston Dallas Shreveport Los Angeles Tulsa St. Louis Seattle Calmes Engineering Co., New Orleans

BUILDERS OF FINE ENGINES FOR 112 YEARS

SOME AIDS TO THE







ARMSTRONG STEAM TRAP

ARMSTRONG *Inverted Bucket*

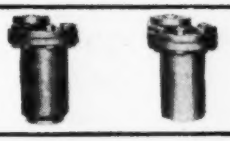
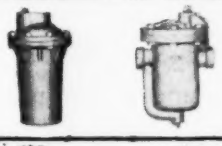
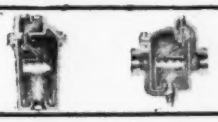
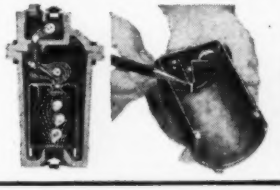
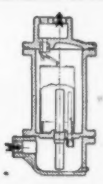
Selection of STEAM TRAPS

In planning the installation of steam traps, it is desirable to have in mind the types of traps available for various services. The chart below, describing briefly the Armstrong Traps available to meet practically any condensate requirements, will serve as a guide.

For complete data, capacity charts, prices, selection procedures, etc., send for your copy of the ARMSTRONG STEAM TRAP BOOK.

ARMSTRONG MACHINE WORKS
812 Maple Street • Three Rivers, Michigan

SAVE COAL!
Keep your traps in good repair. Ask for bulletin on trap inspection and repair.

SERVICE	TYPE OF TRAP
1. HIGH PRESSURE or where all steel fittings are desired. (Up to 2400 P.S.I.)	Armstrong Inverted Bucket Steam Trap with FORGED STEEL body and cap. Screwed or flanged connections. 
2. MEDIUM PRESSURE — coils, kettles, headers, etc. (Up to 250 P.S.I.)	Armsrong Inverted Bucket Trap with cast semi-steel body and cap and same stainless steel mechanism used in forged steel traps. Side-inlet side-outlet or bottom-inlet top-outlet connections. 
3. LOW PRESSURE—unit heaters, coils, etc. (From 1 P.S.I. up.)	Identically the same traps, except for part sizes, as No. 2 above! 
4. WHERE LARGE AMOUNTS OF AIR MUST BE HANDLED —such as on "up-and-down" process units and low pressure heating systems. (Pressures to 250 lbs.)	Armstrong Inverted Bucket BLAST TRAPS capable of handling 500 to 1500 cu. ft. of free air per hour, depending upon bucket size. 
5. WHERE EXCESSIVE AMOUNTS OF CONDENSATE MUST BE HANDLED—steam separators, purifiers, hot water heaters, etc. (Pressures to 900 P.S.I.)	Armstrong PISTON OPERATED Compound Traps with capacities up to 300,000 lbs. of condensate per hour.
6. WHERE PULSATING PRESSURES ARE ENCOUNTERED such as caused by reciprocating engines and pumps. (Pressures to 600 P.S.I.)	Armstrong Inverted Bucket Traps with special separating chambers. 

STEAM TRAPS for POWER PROCESS HEATING

They turned a valve ON AN IDLE PUMP . . . and oxygen contamination

To a Hall engineer, an increase in sodium sulphite consumption suggests oxygen contamination. Consequently when this occurred recently in a certain plant, the Hall representative started to trace the contamination to its source.

The deaerating heater was checked and found to be functioning properly. There was no leakage into the system from the emergency cold water lines.

As the checking continued, appreciable oxygen was found at the pump suction, although there was zero dissolved oxygen at the heater discharge. This definitely identified the pump as the source of contamination—but there was still the problem of how this could happen. Once the source of contamination was determined, the plant engineer knew the answer. The feed pumps in use at the plant require equalizing pipes which carry away any leakage from the last stage sealing sleeves. The engineer remembered that, when the pumps were put in, these equalizing pipes were not carried back to the pump suctions but discharged into one of the intake pipes of the feed water heater. This particular intake pipe returns power house condensate, which contains considerable oxygen, to the heater.

Since one pump was always idle, the pressure in the equalizing line of that pump was less than that on the power house condensate line, hence undeaerated condensate could leak back through the equalizing line and into the pump suction. From this point it was picked up and sent into the boilers.

The whole problem was solved by merely shutting the valve in the pump suction line to the idle pump.

This incident is an excellent example of cooperation between the Hall service engineer and the plant engineer. The Hall representative, as part of regular Hall service, checked every phase of operation until the trouble was definitely located. With that help, the plant engineer was able to use his detailed knowledge of the equipment to determine how the contamination could occur and to correct it.

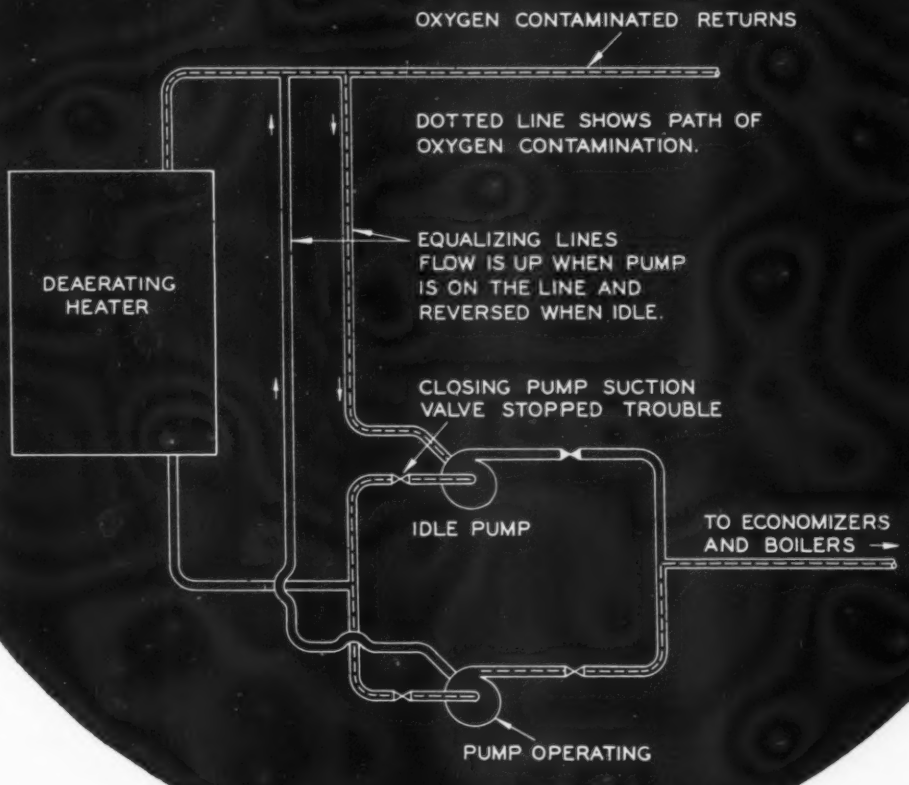
Every plant that generates its own steam power can profitably use Hall Service. Write us for full information.

HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH 30, PA.

A subsidiary of Hagan Corporation

HAGAN
HALL
BUROMIN
CALGON

STOPPED


OXYGEN CONTAMINATED RETURNS
DOTTED LINE SHOWS PATH OF OXYGEN CONTAMINATION.
DEAERATING HEATER
EQUALIZING LINES FLOW IS UP WHEN PUMP IS ON THE LINE AND REVERSED WHEN IDLE.
CLOSING PUMP SUCTION VALVE STOPPED TROUBLE
IDLE PUMP
TO ECONOMIZERS AND BOILERS
PUMP OPERATING

HALL SYSTEM *of Boiler Water Conditioning*

HERE'S WHAT HALL CLIENTS GET:

1. Thorough study of all factors concerning water involved in producing steam.
2. Procedure for the proper treatment of boiler water.
3. Instruction of designated employees in making of essential control tests.
4. Periodic check up by Hall service engineers.
5. Periodic checking of samples by Hall Laboratories.
6. "Trouble shooting" that includes all service necessary as problems arise.

—all of which adds up to *boilers that stay on the line!*

D-279-T

Victory Will Mean

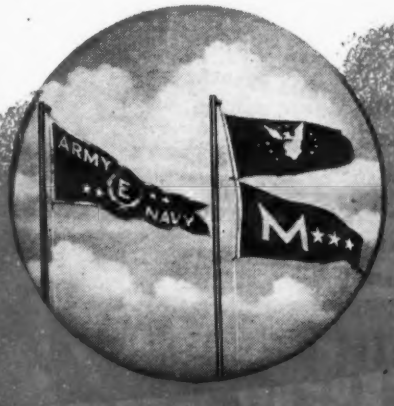
NEW JOBS *for* STEAM

Steam will blow the whistles when the big news comes. But, in heralding the great day, steam will have done far more than sound the signal for rejoicing.

Beyond steam's part in victory . . . beyond its record of powering ships, trains, war plants, there will be thousands of stories of men . . . *engineers* . . . men with trigger minds instead of trigger fingers . . . who tackled power plant problems with keen resourcefulness so that power for war needs would never be "too little or too late". With the end of hostilities will come new Victory jobs for steam . . . new problems . . . keener competition that will put emphasis on operating costs.

With today's accelerated experience yielding more complete answers to such problems as behavior of metals at high temperatures, action of fuels in slag-tap and dry-ash furnaces, circulation in high-capacity high-pressure boilers, separation of steam from water in boiler steam drums, and other related problems, the boilers of tomorrow will be even better able to serve industry.

Building boiler units complete with all essential components . . . controlling both the design and the application of the equipment fabricated . . . these, plus extensive facilities, give us at B&W a background that's unique. As a result our engineers have at their disposal an array of boilers from which to meet any combination of conditions of capacity, pressure, temperature, feedwater, fuel, and space. Now is a good time to consult with us regarding your steam plant requirements for the future.



Army-Navy "E" flags have been awarded to five B&W plants, and also the Maritime Commission Award flags to the Barberton, Ohio, Plant.

BABCOCK & WILCOX

HE BABCOCK & WILCOX CO.
5 LIBERTY STREET, NEW YORK 6, N. Y.

TOUGH, WILLING and ABLE ! REDWING H CORD AIR HOSE

IF high-speed war production has been causing quick failure in your air hose and increasing maintenance costs — sound practice is to standardize on Goodyear Redwing H Cord Air Hose.

Here's an air carrier that's tough, willing and able to stand the gaff of the most punishing air hose jobs. Redwing has always been tops in quality — and now it's even better than it ever was before.

Redwing H Cord Air Hose is doing yeoman duty in shipyards, steel mills, mines, quarries, heavy war industries of all kinds. Everywhere it's in use, it is giving an outstanding account of itself, smoothing the flow of production and keeping maintenance costs and need for replacement at the minimum. Try it yourself — and you'll soon learn why users are so enthusiastic about this heavy-duty hose.

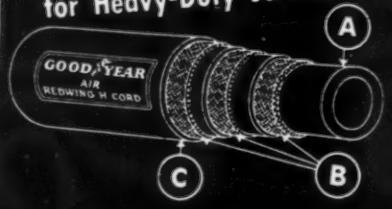
Made in continuous lengths, in seven sizes up to 1½" diameter. Order from the G.T.M. — Goodyear Technical Man — or phone your nearest Goodyear Industrial Rubber Products Distributor.

Redwing—T.M. The Goodyear Tire & Rubber Company

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified

Redwing H Cord Air Hose for Heavy-Duty Service



A Highest quality synthetic rubber tube, nonporous, impermeable to oil

B Multiple braids of cabled cotton cord give high safety factor

C Heavy-gauge, high-tensile cover resistant to cutting: non-oxidizing

ALL OUT FOR THE MIGHTY 7th—BUY MORE WAR BONDS!

FOR HOSE, BELTING, MOLDED GOODS, PACKING AND OTHER INDUSTRIAL RUBBER PRODUCTS built to the world's highest standard, phone your nearest GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR.

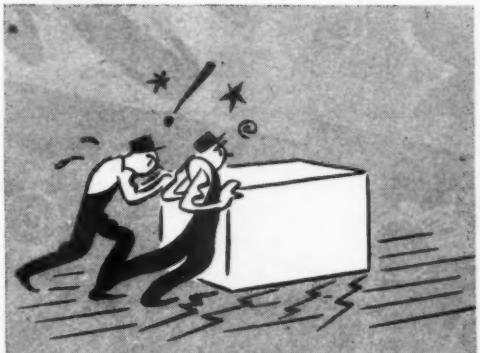
GOODYEAR

THE GREATEST NAME IN RUBBER

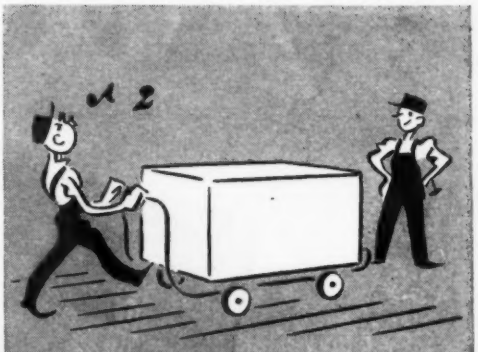
FIGHT FRICTION!

It's Electric Motor Enemy No. 4...

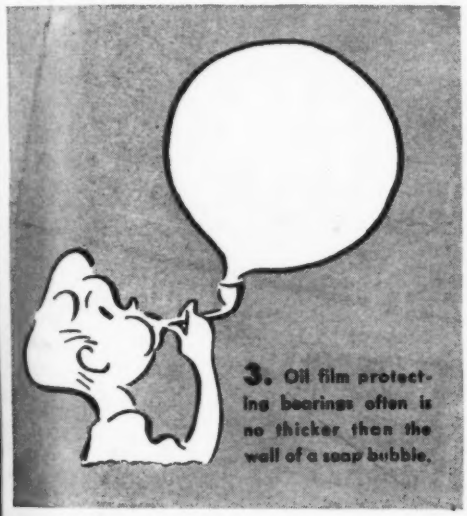
In Allis-Chalmers' new "Guide to Wartime Care of Electric Motors".



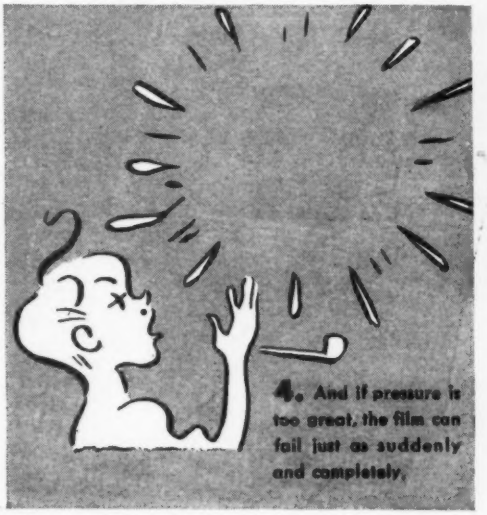
1. Like a motor without oil. Simple! Yet every day hundreds of workers overlook the importance of adequate motor lubrication.



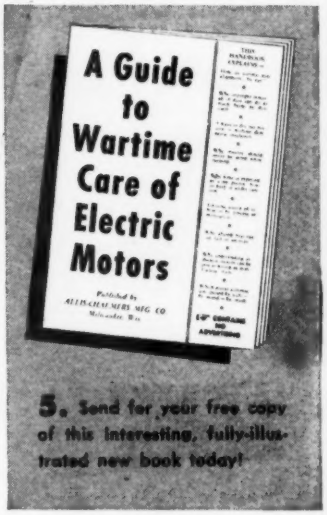
2. Like a motor with oil. Pictures like these make motor maintenance easy to put across in training new employees.



3. Oil film protecting bearings often is no thicker than the wall of a soap bubble.



4. And if pressure is too great, the film can fail just as suddenly and completely.



5. Send for your free copy of this interesting, fully-illustrated new book today!

ONE OF A MOTOR'S most dangerous enemies is friction. In peacetime, instructions for guarding against it were based on 8-hour-day, 6-day-week operation. Today, with motors working up to *3 and 4 times* as many hours a week, those instructions are dangerously obsolete!

To help put U. S. motor maintenance on an efficient wartime footing, Allis-Chalmers has published "Guide to Wartime Care of Electric Motors". This valuable book explains the *9 main enemies* of electric motors . . . tells you how to fight them. Its recommendations are simple and practical . . . ideal for training new men or as a review for experienced men. Book is fully illustrated with stimulating, understandable sketches like those shown above—*contains no advertising*. Over 100,000 copies in use by industry and armed forces. Send for your *free* copy today! ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

A 1658

ALLIS-CHALMERS MOTORS

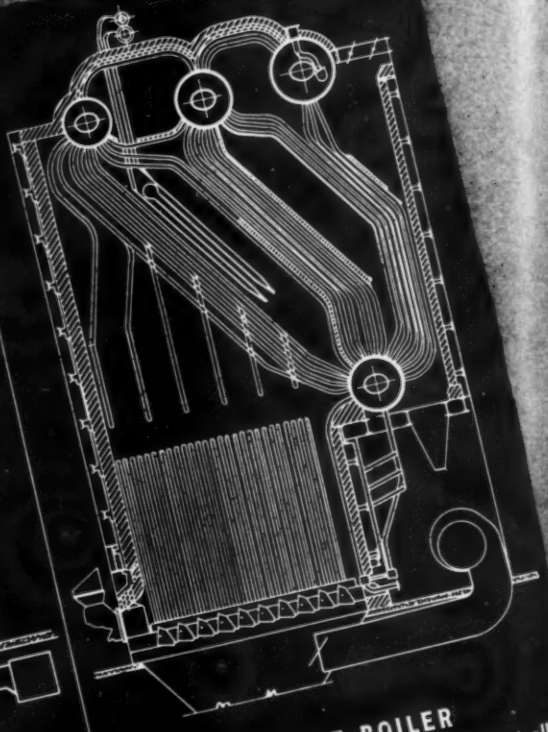
When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

Vogt Steam

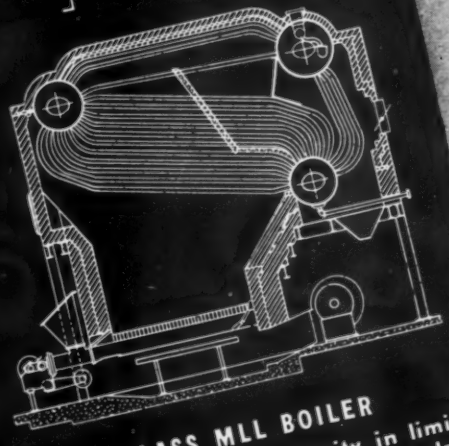
SECTIONAL HEADER BOILER

Sinuous forged steel headers feature this straight tube, cross-drum type generator. Staggered tubes achieve high heat transfer rate and insure efficient operation.



CLASS LE BOILER

Unsurpassed for quick steaming at all ratings, this four drum, bent tube type will carry high overloads with high efficiency.

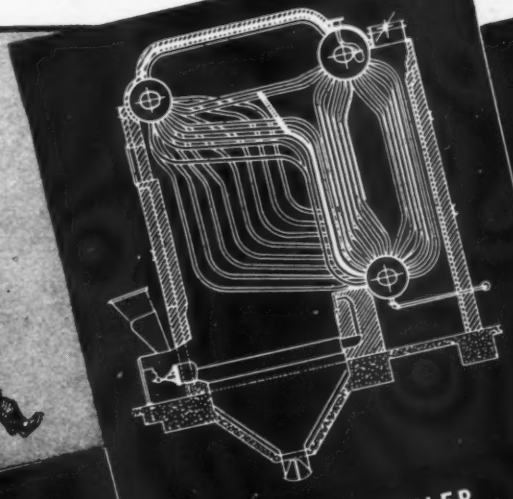


CLASS MLL BOILER

Provides maximum capacity in limited headroom. Widely used in industrial plants, institutions, etc., having moderate processing or power loads, and for heating.

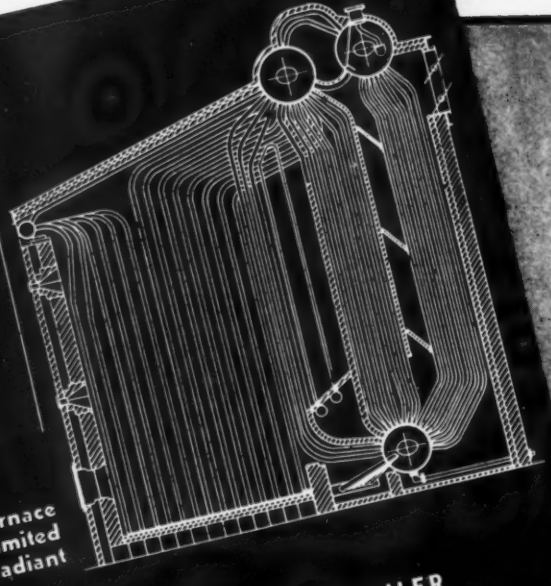
HENRY VOGT MACHINE CO., Inc.

GENERATING UNITS



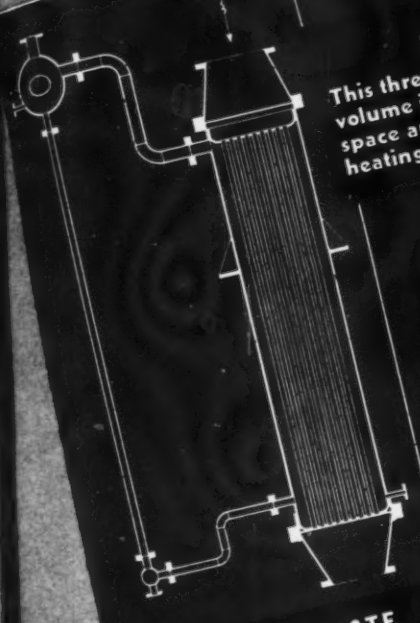
CLASS VL BOILER

This three drum design has large furnace volume in a unit which occupies limited space and provides high ratio of radiant heating surface.



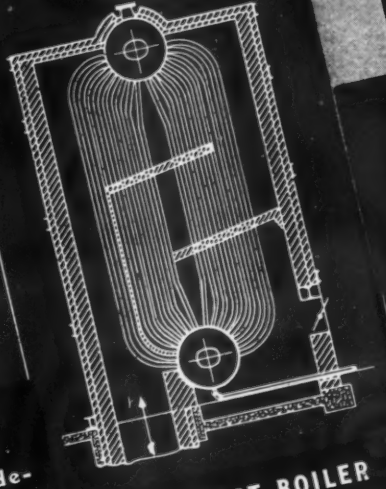
CLASS VR BOILER

An efficient, high-duty unit with water-cooled furnace for suspended fuel firing, such as powdered coal, oil, or gas.



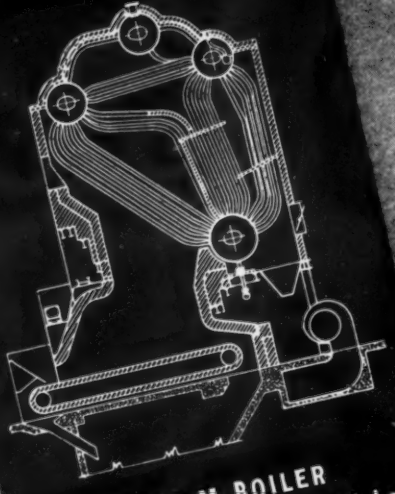
REFINERY WASTE HEAT GENERATOR

Shell and tube type designed to utilize high temperature gases from refinery processes such as those from catalytic units.



WASTE HEAT BOILER

A water-tube type which utilizes the heat in waste gases as produced by numerous industries. Designs will accommodate gases having high dust content.



CLASS M BOILER

This four drum, bent tube unit has the steam drum above the water level and delivers steam with 15°-18° superheat.

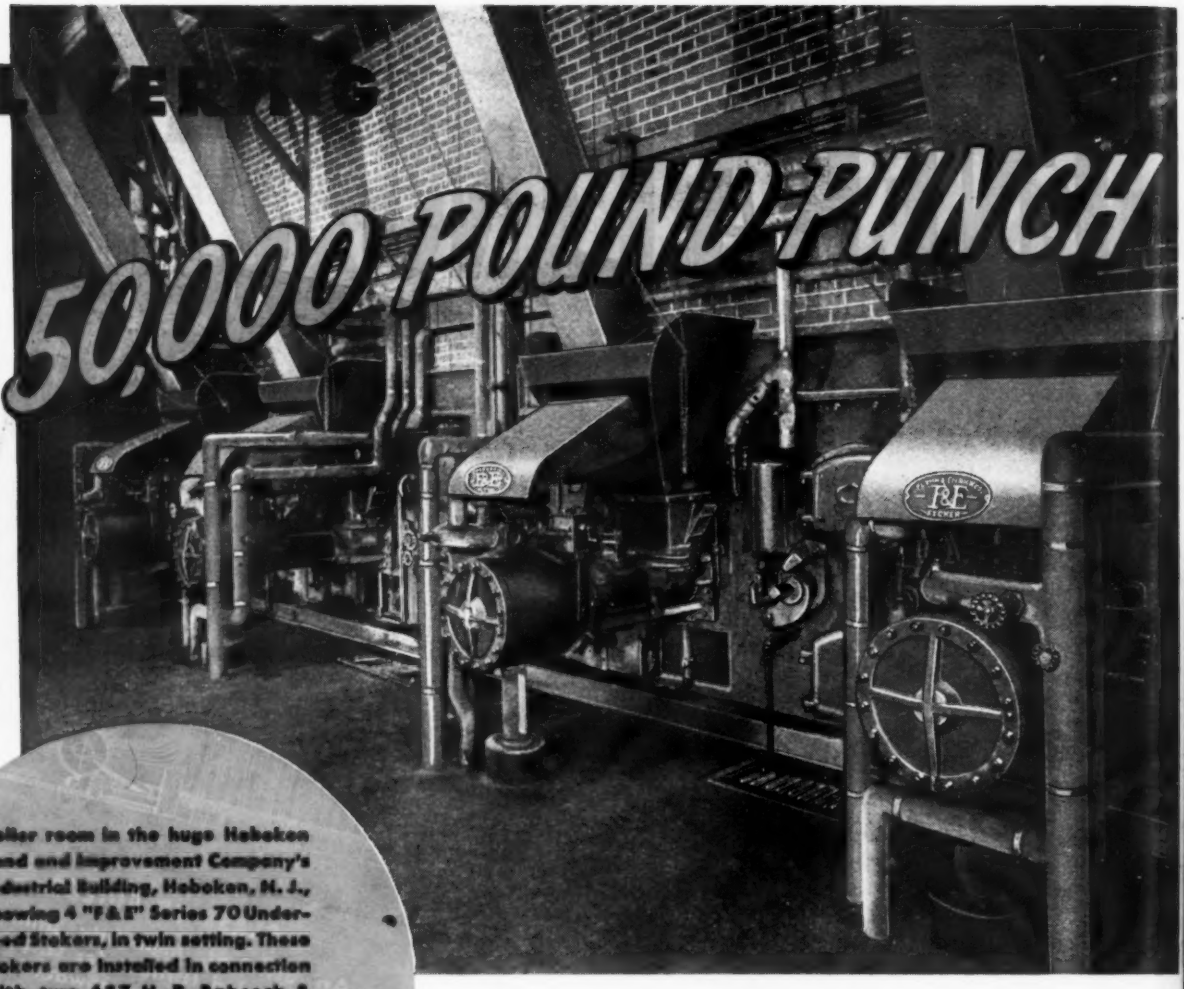
1000 WEST ORMSBY STREET
LOUISVILLE 10, KENTUCKY

●

BRANCH OFFICES: *New York* • *Chicago* *Cleveland* • *Philadelphia* • *Dallas*

DEL[illegible]

A 50,000 POUND-PUNCH



Boiler room in the huge Hoboken Land and Improvement Company's industrial building, Hoboken, N. J., showing 4 "F&E" Series 70 Underfeed Stokers, in twin setting. These stokers are installed in connection with two 687 H. P. Babcock & Wilcox horizontal water tube boilers. They are designed to produce 44,000 lbs. of steam per hour continuously during each day and 50,000 lbs. of steam for two hour peaks.

DRIVING POWER TO PRODUCTION GOALS!

The concentrated purpose of the "F&E" combination of engineered features is *dependable, trouble-free production of steam power.*

Designed expressly for industrial boilers in plants and large buildings where power controls production, "F&E" Underfeed Stokers, Series 70, are built for rugged service.

Meeting the power demands of continuous daily schedules or peak loads, "F&E" Stokers assure positive control of power production through accurate regulation at all coal feeding and air supply rates. The "F&E" Steam Drive is recognized as a most simple, direct and economical drive. Operating with steam from the boiler direct to the stoker ram, all intermediate driving equipment is eliminated.

See your consulting engineer or local "F&E" Representative who can give you complete details and data on "F&E" Stokers for large and small industrial and commercial uses.

FLYNN & EMRICH CO.

Established 1842

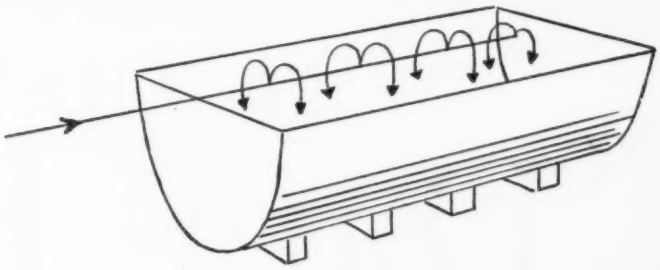
HOLLIDAY AND SARATOGA STS., BALTIMORE 2, MD.

Representatives in Principal Cities

F&E UNDERFEED STOKERS

HYDRAULIC DRIVE AND STEAM DRIVE FOR BOILERS PRODUCING 10,000 TO 50,000 LBS. OF STEAM PER HOU

The Problem —
To distribute coal evenly to all parts of long bunker



And Here's the S-A Answer

Whatever your coal handling problem, there's an S-A answer that means full efficiency at every handling step.

That's a broad statement, but one which S-A has backed up many times with actual time and money saving installations.

Here, the specific problem was utilizing the full capacity of a bunker. And the specific answer was an S-A Belt Conveyor traveling the entire bunker length, with coal discharging through an S-A Tripper.

Now as coal is carried along the belt, it can be discharged to both sides, to distribute coal evenly throughout the bunker and utilize full bunker capacity.

The next time you plan improvement or extension of your present coal handling system, get S-A's slant on how it can be done most efficiently.

Above: Close-up view of one of several styles of S-A Conveyor Belt Trippers, a simple, sturdy tripper for use on moderate size installations. Tripper can be driven from either side.

Left: View down the coal bunker, showing S-A Self-propelling, Self-reversing Tripper at far end. Tripper straddles belt for entire bunker length, with spout discharging to both sides.

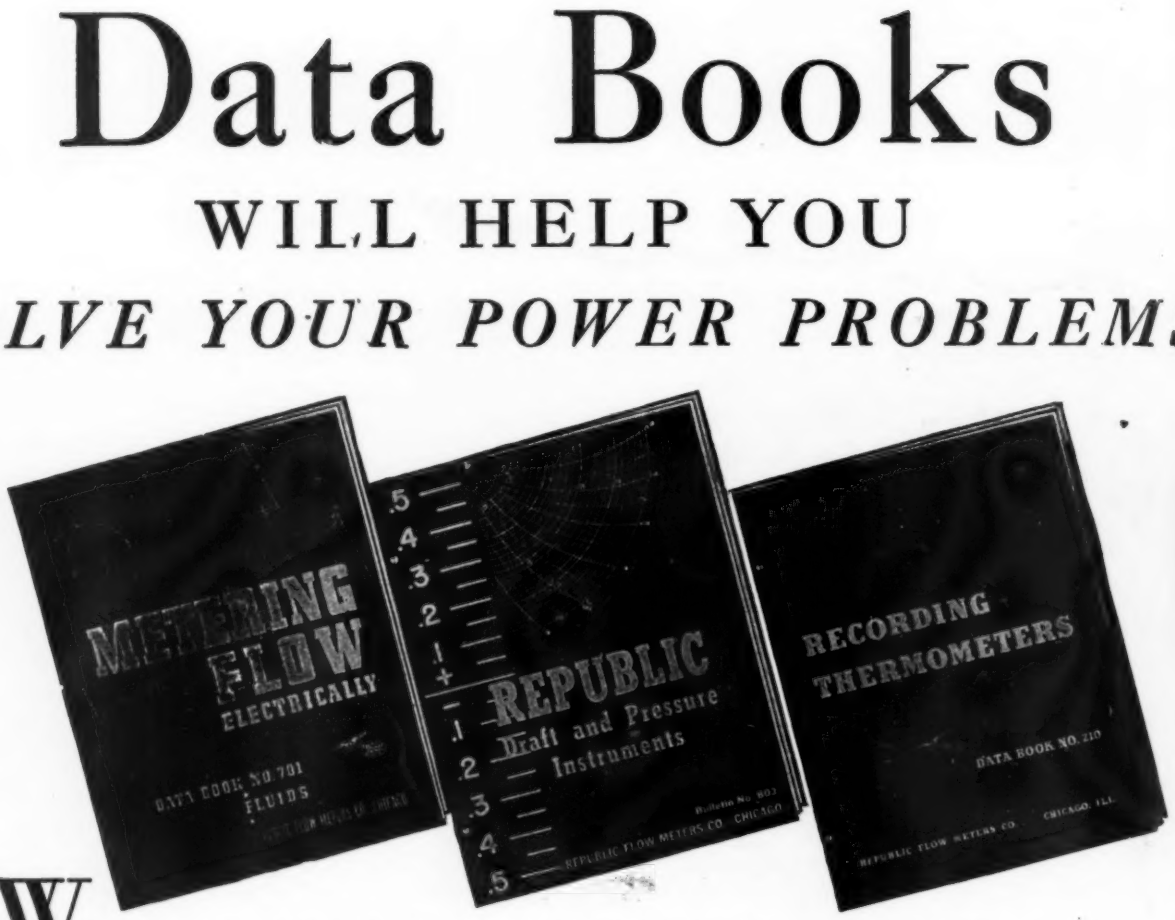
STEPHEN S-A ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS ★ LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

THESE
Data Books
WILL HELP YOU
SOLVE YOUR POWER PROBLEMS



WRITE for these data books now! They are filled with important power plant data generally difficult to locate. When your increased power load demands the installation of new units or the "stretching" of existing plant capacity, you will need this information.

REMOTE READING FLOW METERS — Data Book No. 701

For measuring flow of steam generated by each boiler and the total produced; steam consumed by prime movers and process steam consuming units; water supplied to boilers and pumped to processes; rate of generation, distribution and consumption of natural gas, coke oven gas, compressed air and the like; flow of fuel oil, brine, black liquor and so on; the Republic electrical type flow meter with remote reading instruments, as described in this book, is available.

MECHANICAL FLOW METERS — Bulletins No. 110 and No. 311

When it is desired to measure flow of steam, water, gas, air or oil for the same purposes as outlined above but where remote registration is not required, the Republic mechanical meters described in these books are available.

DRAFT AND PRESSURE INSTRUMENTS — Bulletin No. 802

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic indicators and recorders, described in detail in this bulletin, are supplied in any desired combination for all ranges encountered in furnace operation.

REPUBLIC INSTRUMENTS AND CONTROLS

RECORDING THERMOMETERS — Data Book No. 210

Measurements of temperature of flue gas, temperatures in vats or tanks, pipe lines, refrigeration systems, ovens, kilns or ducts and so on, are vital in maintaining highest capacity and efficiency in power plant and process equipment. Republic recording thermometers for this service are described in this data book.

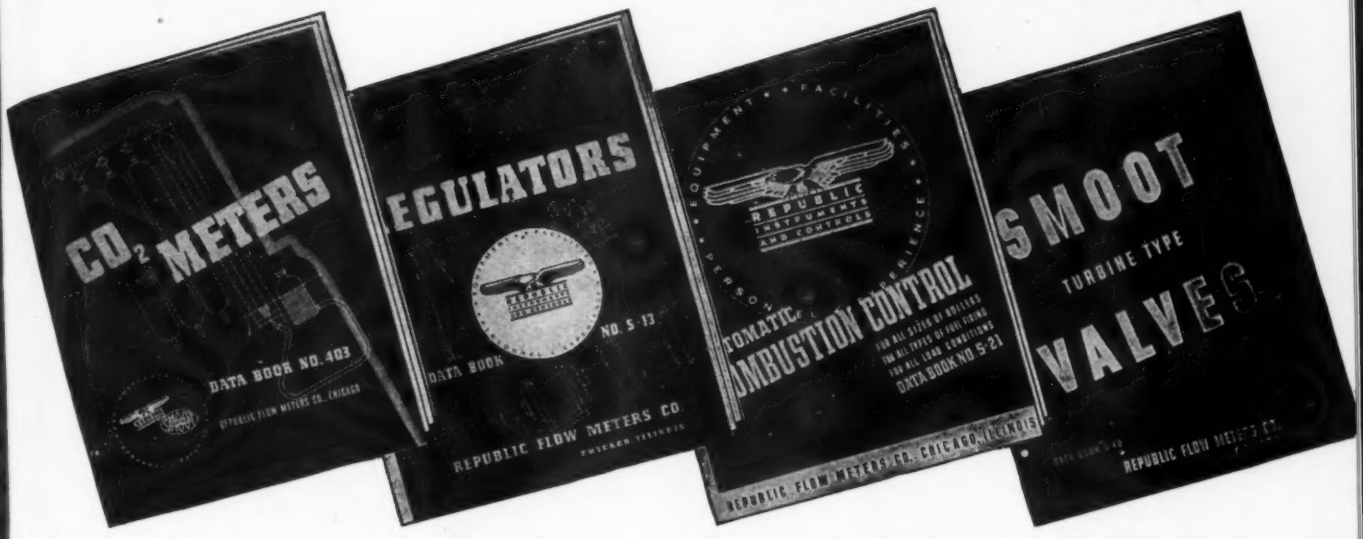
CO_2 METERS — Data Book No. 403

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. The CO_2 meter is the most practical method of determining combustion efficiency. The construction and operation of the Republic CO_2 meter are described in detail in this book.

Republic-Smoot automatic combustion control systems are built for all sizes of boilers, all types of fuel firing and all load conditions, as described in this book, which includes detailed installation reports giving performance data on outstanding power plants.

REGULATING VALVES — Data Book No. S-40

In any plant generating high-pressure, high-temperature steam, there are key valves doing tough jobs in controlling flows or pressures on which vital operations depend — pressure reducing valves co-ordinating high and low pressure steam systems, feedwater valves on 1500 lb. boilers. For such tough jobs, where responsibility, long life and accurate regulation count most and failure must not occur, the Republic-Smoot valves described in this bulletin have been designed.



REGULATORS — Data Book No. S-13

Control of rate of flow of liquids and gases, level of liquids, speed of turbines, engines and motors and proportions between variable pressures and flows must be accurate if maximum plant efficiency is to be attained. These factors are controlled by operation of valves, dampers, rheostats, etc. For sensitive, fast, stable and powerful automatic control of these devices, the Republic-Smoot regulator has been developed. Its construction, operation and applications are described in this book.

AUTOMATIC COMBUSTION CONTROLS — Data Book No. S-21

Boilers must produce maximum steam output at maximum efficiency. That means constant steam pressure, maximum combustion efficieney, constant and correct furnace draft, desired load division among boilers.

DESUPERHEATERS — Data Book No. S-35

In the modern power plant, steam temperatures in interconnected systems — topping turbine bypasses, tie lines, turbine exhaust lines and process steam headers — must be accurately controlled by desuperheaters. For such exacting services, the Republic-Smoot desuperheaters described in this book are employed.

★ ★ ★ ★

Republic Flow Meters Co. offers a complete manufacturing and engineering service in the field of measurement and control. We will be glad to co-operate with you in the solution of any metering or control problem, whether it involves a single instrument or the automatic control of an entire process or plant. Your inquiries will involve no obligation on your part.

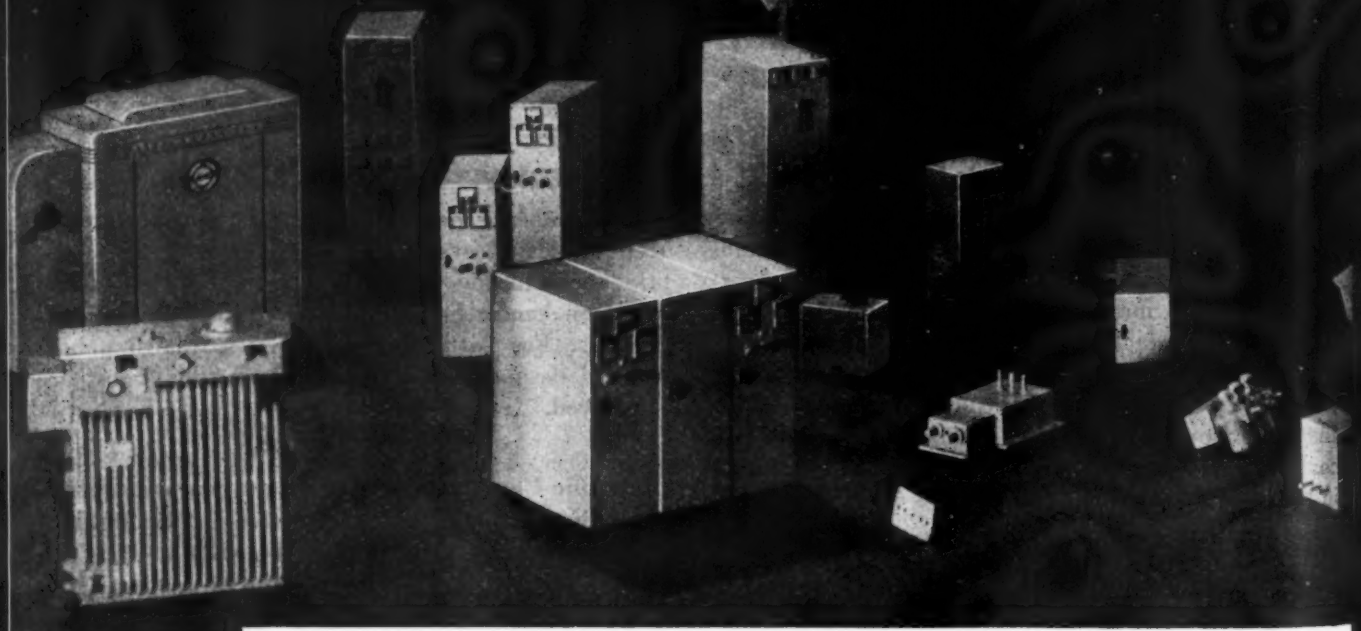
Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

Pre-Test Your U

Scale of Models: 1" = 1'

With these accurate scale models of Allis-Chalmers Prefabricated Unit Substation apparatus, you can quickly see what's available, how it can fit together, how power distribution arrangements will look in your own plant!



IT'S SO SIMPLE, so practical, so fast—*visual planning* of substations with Allis-Chalmers' new "Unit Sub Builder" Set!

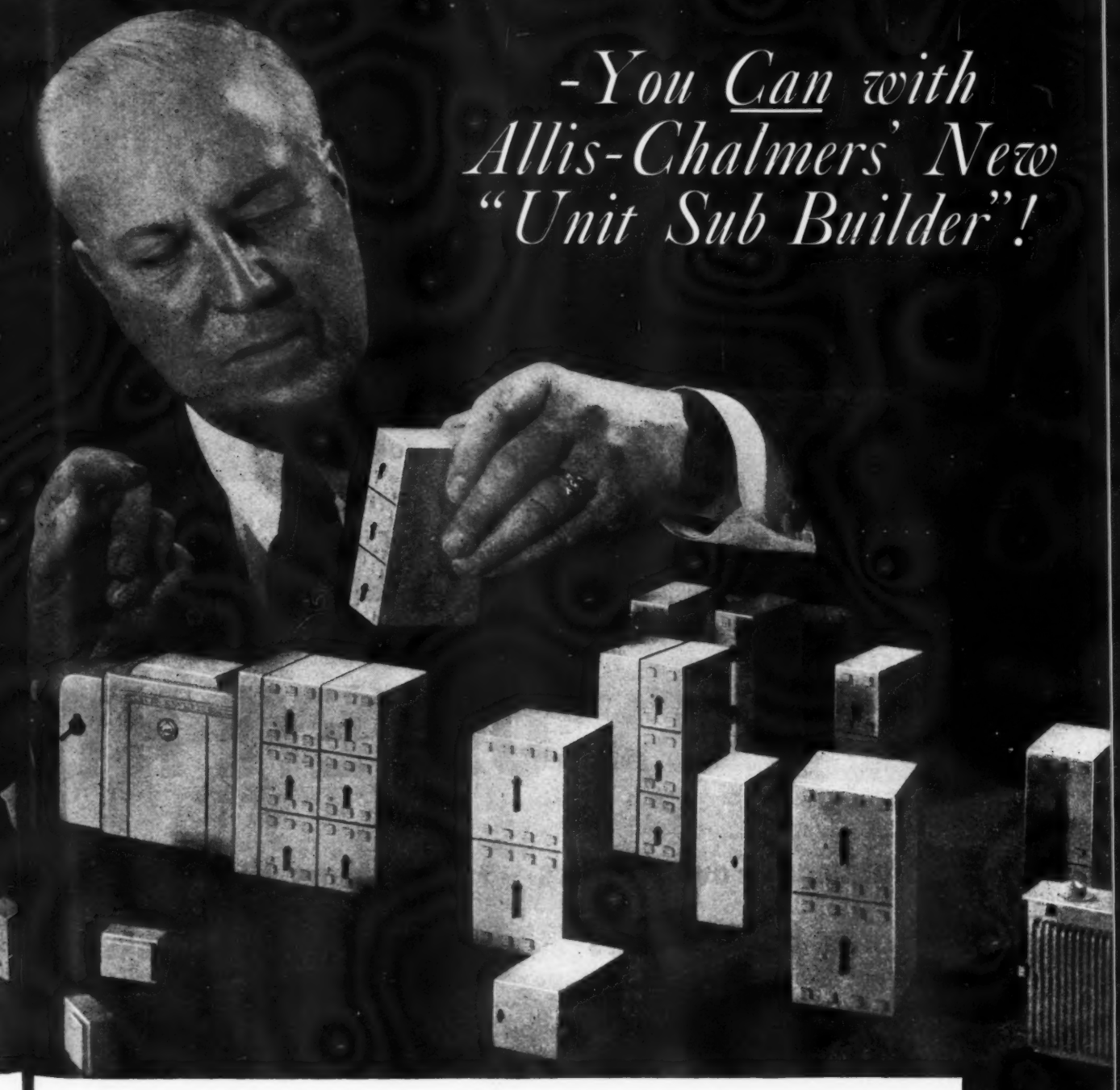
And it's good insurance — you *pre-test* your ideas — *see* just what you're getting in terms of dimensions, characteristics, appearance.

Here are the elements Allis-Chalmers Prefabricated Unit Substations are made of — in accurate scale models — plus a new "Unit Sub Slide Rule" to simplify breaker calculation, a new "Unit Sub Check List" to give you the added planning safety of a *double* check.

Right on the top of your desk you can build up all possible solutions to your power distribution problems — compare them from every point of view. For the ultimate in visualization, you can have a floor plan of your factory drawn to the same scale as the models — ½ inch to 1 foot —

Unit Sub Ideas

-You Can with Allis-Chalmers' New "Unit Sub Builder"!



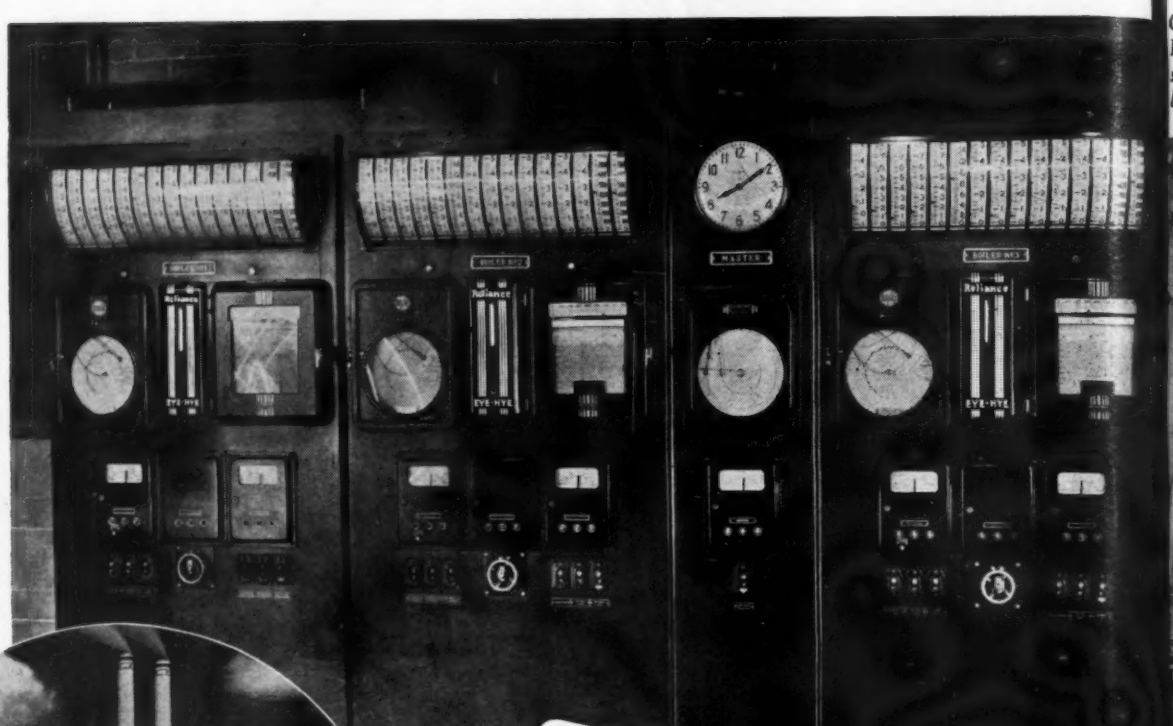
and build up your unit sub *right where it will stand!*

This new service is yours with *no obligation.* Call your nearby Allis-Chalmers district office for a demonstration of the new "Unit Sub Builder", by an Allis-Chalmers field engineer. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN.

• • • A 1747

♪ *Tune in the Boston "Pops", Blue Network, every Sat. Eve.*

Work Out Your Ideas with
ALLIS - CHALMERS
"Unit Sub Builder" Set!



Remote Reading Water Level Indicator • Completely Hydrostatic

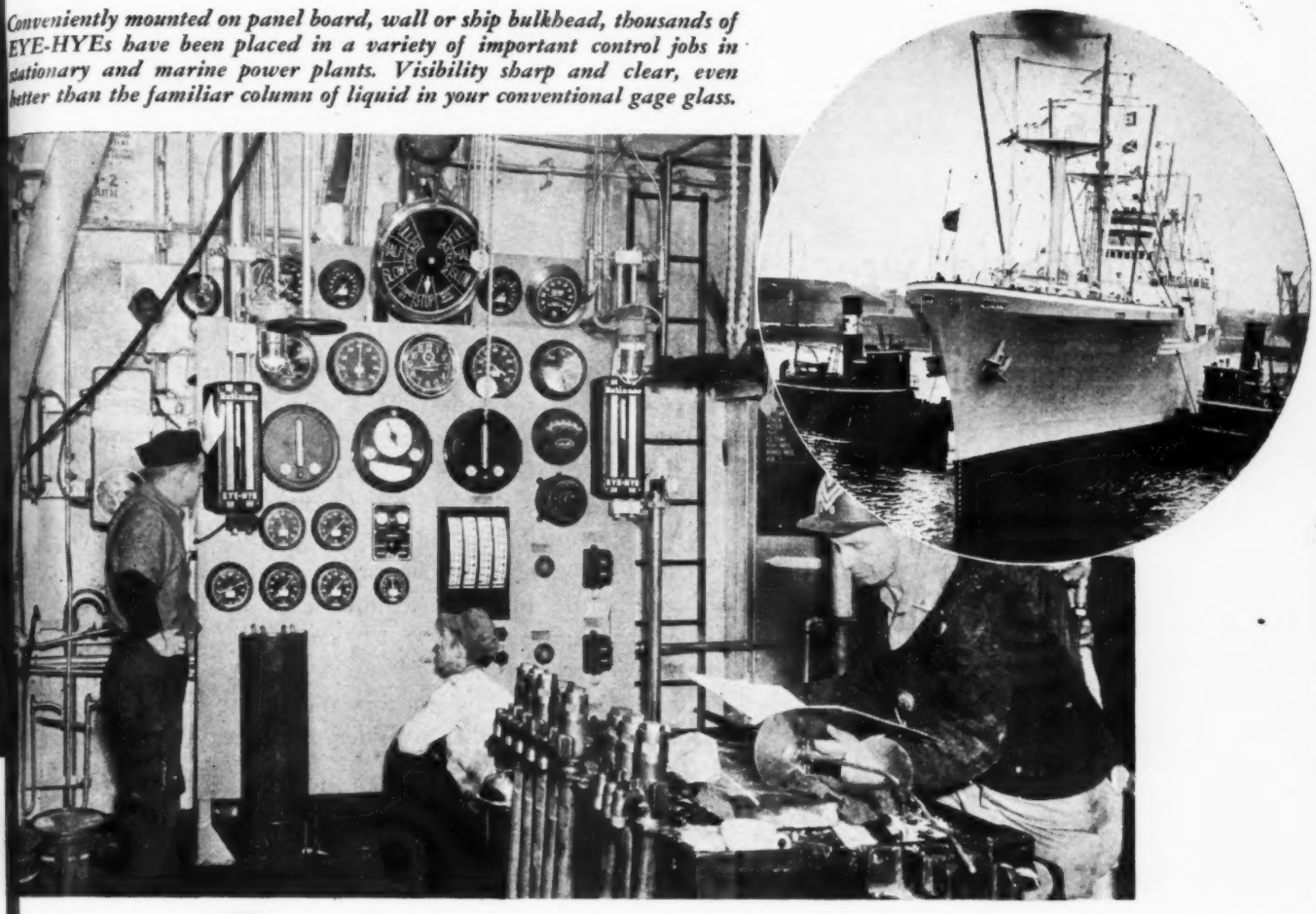
Use EYE·HYE

★ Stationary Power Boilers
★ Marine Power Boilers
★ Waste Heat Boilers
★ Heating Boilers
★ Storage Tanks
★ Feed Water Heater Tanks
★ Water Treatment Tanks
★ Mercury Vapor Boilers
★ Surge Tanks

Since 1884

Reliance

Conveniently mounted on panel board, wall or ship bulkhead, thousands of EYE-HYEs have been placed in a variety of important control jobs in stationary and marine power plants. Visibility sharp and clear, even better than the familiar column of liquid in your conventional gage glass.



Anywhere ★

FOR dependable protection against water level accidents and inefficient operation, Reliance EYE-HYE gives you trouble-free indication in familiar water gage form. Its adaptability, and flexibility of placement, have made it popular with engineers responsible for safe water level supervision. The quickly-read illuminated column of green liquid can be placed a considerable distance from and above or below drum or other vessel. EYE-HYE accurately measures liquids on low pressures, even under vacuum, and as high as 2000 lbs. Completely hydrostatic operation with special patented features guarantees consistent, reliable operation. Approved by leading power authorities and consulting engineers—thousands in daily service, protecting vital steam producing capacity. Write for Bulletin 382-C.

BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
Cleveland, Ohio

A routine test

that could wreck the plant

made safe by

HAGAN

CONTROL

THE BOILER PLANT of one of the country's largest steel plants consists of four 2500 H.P. boilers operating at 450 pound pressure. Primary fuel is blast furnace gas, with powdered coal make-up when gas supplies are inadequate.

Continued feeding in case induced-draft fan motors were out of operation might easily wreck the plant—but once a month, for nine years, the plant engineers *deliberately created this emergency.* They provided a special test switch that opened the circuit to these motors and set up exactly the same situation that would result in case of power failure.

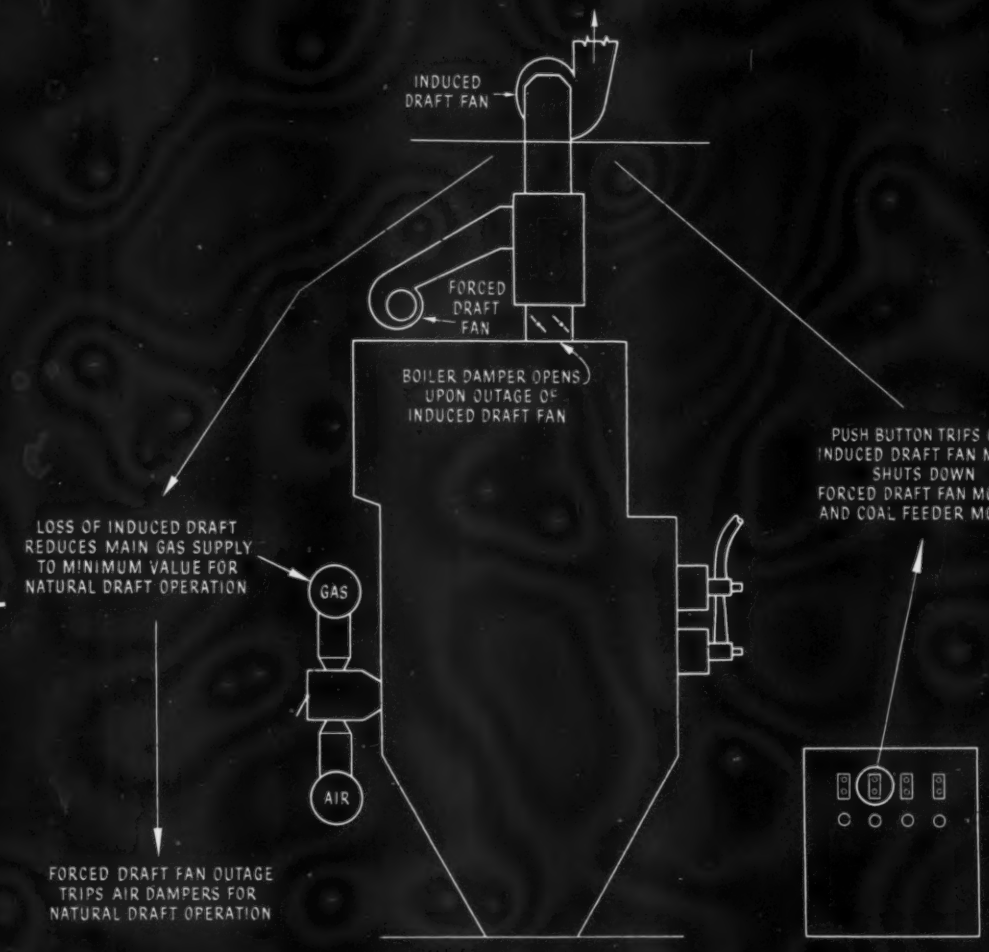
With Hagan Control on the job, here is what happened:

As soon as the induced-draft fans were cut off, the forced-draft fans shut down, the boiler damper opened wide, the feeder motors stopped, air inlets from atmosphere to the gas burners were opened, and the gas control valve closed to a point where it passed only the amount of gas which could be burned with natural draft.

In a matter of seconds, the boiler was automatically and safely adjusted to a reduced rating, with natural draft, until electric power was restored.

This plant has completed 13 years of steady operation, with Hagan Automatic Combustion Control maintaining constant steam pressure in spite of extreme load swings and frequent transitions from one type of fuel to the other.

This great record of dependability is made possible by the Hagan principle that *control and recording are separate functions.* Hagan Control continues to function reliably at ranges well below those at which meter accuracy is guaranteed. Every instrument on the panel can be out of service without affecting the precision and reliability of Hagan Automatic Combustion Control.


INDUCED DRAFT FAN
FORCED DRAFT FAN
BOILER DAMPER OPENS UPON OUTAGE OF INDUCED DRAFT FAN
PUSH BUTTON TRIPS OUT INDUCED DRAFT FAN MOTOR, SHUTS DOWN FORCED DRAFT FAN MOTORS AND COAL FEEDER MOTORS
LOSS OF INDUCED DRAFT REDUCES MAIN GAS SUPPLY TO MINIMUM VALUE FOR NATURAL DRAFT OPERATION
GAS
AIR
FORCED DRAFT FAN OUTAGE TRIPS AIR DAMPERS FOR NATURAL DRAFT OPERATION

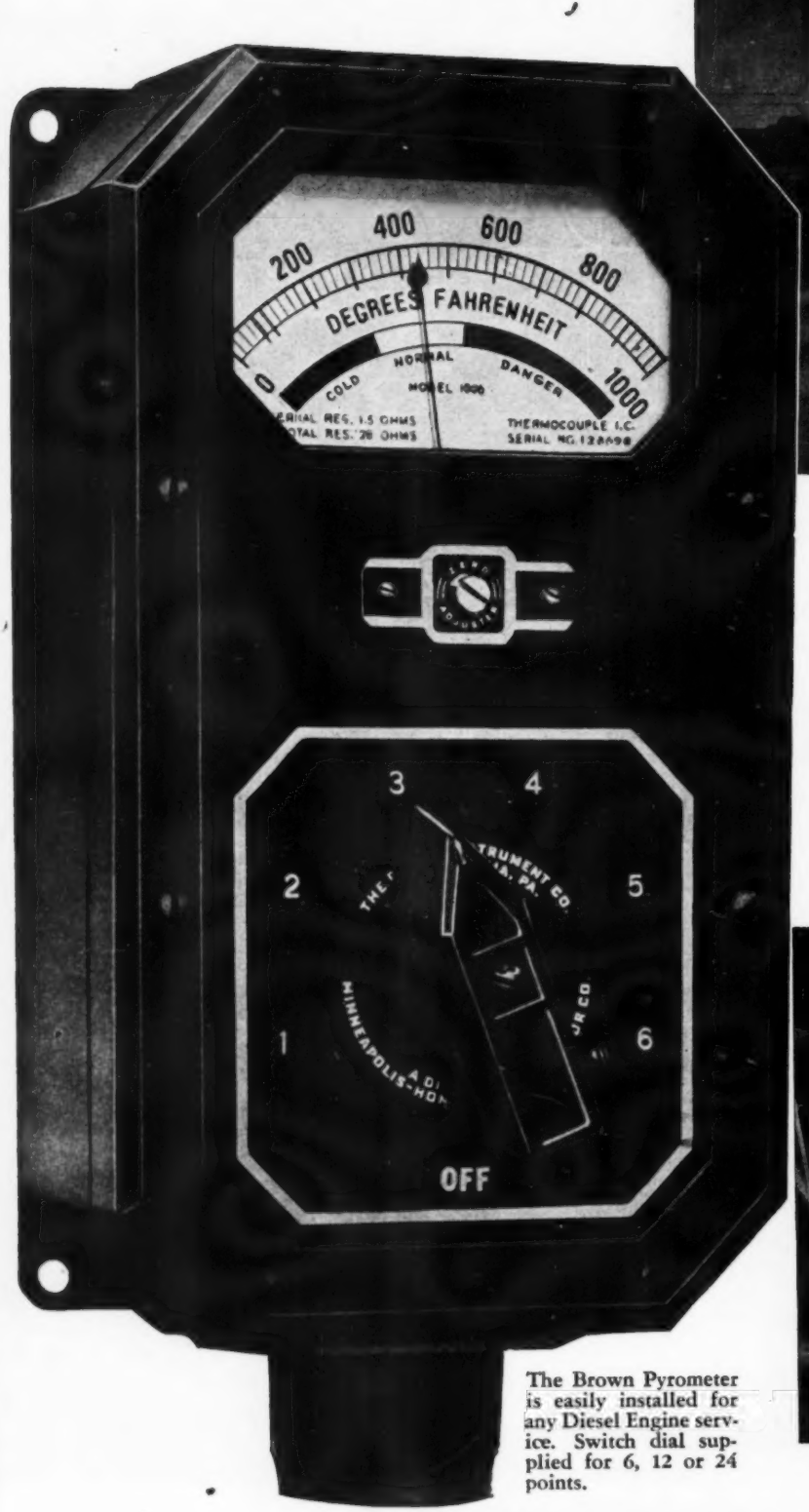
Write for full information

HAGAN CORPORATION • HAGAN BUILDING • PITTSBURGH 30, PA.

HAGAN HALL BUROMIN CALGON

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader



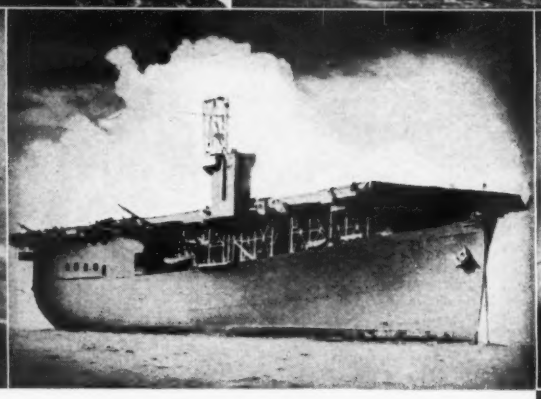
The Brown Pyrometer is easily installed for any Diesel Engine service. Switch dial supplied for 6, 12 or 24 points.

Right: Brown Diesel Thermocouple for long immersion

Below: Brown Diesel Thermocouple for short immersion

Brown Thermocouples in Cylinder Exhaust Headers of a 6 cylinder Diesel Engine

BROWN DIESEL



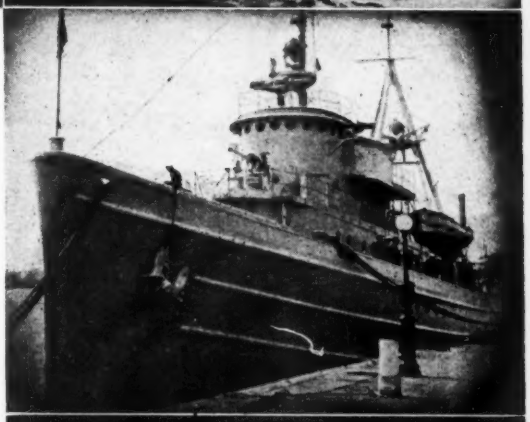
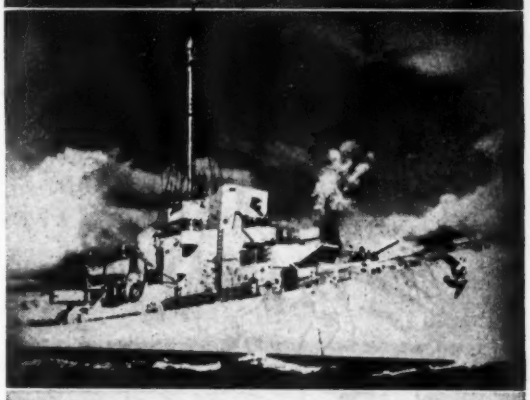
Check Exhaust Temperatures *for* DIESEL ENGINE EFFICIENCY

In the operation of Diesel Engines, it is essential that the load be distributed uniformly, otherwise it is evident that one or more cylinders must carry an overload. Serious damage to the engine may result when the load is unbalanced. It has been proved by extensive tests that the exhaust gas temperatures are the accurate guide in determining even load distribution on all cylinders.

"Maximum efficiency" under all loads might well be the watchword of Diesel Engines equipped with Brown Pyrometers. A click of a switch—a glance at the clear open dial—and the operator can quickly compare the temperature of each cylinder that insures maximum operating efficiency.

Wherever Diesel Engines are used—in industry—in transportation and on the sea, Brown Pyrometers have earned the preference of exacting engineers and the leading builders of Diesel Engines, because of their accuracy, simplicity, ruggedness and dependability.

For information, write the Brown Instrument Company, 4490 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

L ENGINE PYROMETER

What does it ... for air,

Fig. 1640
"King Clip" Gate

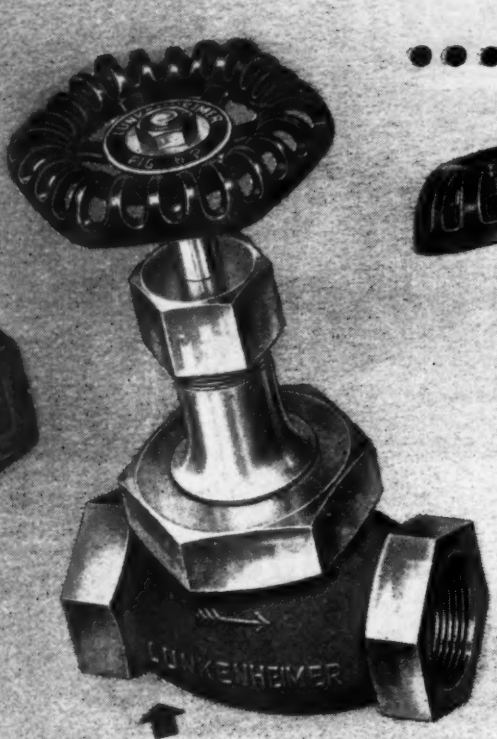


Fig. 16-P
Bronze Globe

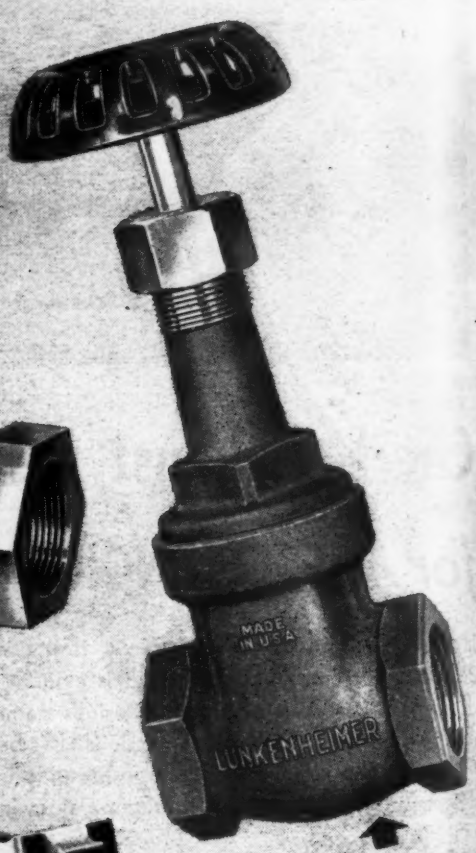


Fig. 2125
Bronze Gate

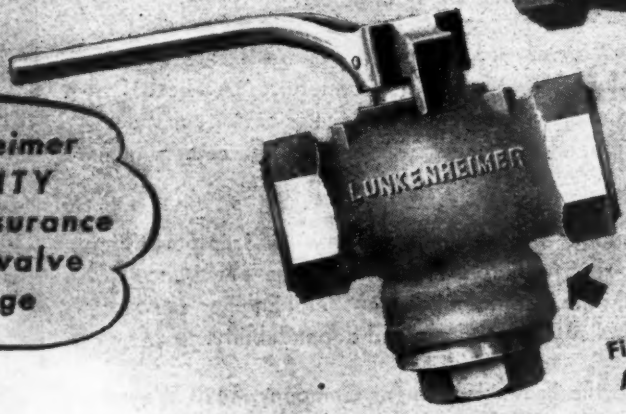


Fig. 1571
Air Cock

Lunkenheimer **QUALITY** *is your insurance against valve leakage*

LUNKENHEIMER

cost you each month

steam, water, you never use?

AREA OF LEAK	AIR		STEAM		WATER	
Diameter Inches	Number of cubic feet per month at 75 lb. pressure	Total cost of waste per month 11c per 1000 cubic feet	Pounds wasted per month at 160 lb. pressure	Total cost of waste per month 65c per 1000 lb.	Gallons wasted per month at 60 lb. pressure	Total cost of waste per month 16c per 1000 gallons
1/2"	13,468,000	$1,481.44	1,219,280	$792.53	1,524,100	$243.86
3/8"	7,558,500	831.44	684,290	444.79	855,360	136.86
1/4"	3,366,990	370.37	304,820	198.13	381,020	60.96
1/8"	824,570	90.70	74,650	48.52	93,310	14.93
1/16"	213,000	23.43	19,280	12.53	24,110	3.86
1/32"	52,910	5.82	4,790	3.11	5,990	.96

Maybe you've never checked the actual cost of valve leakage. If you haven't, you'll doubtless be startled at these figures.

A single valve leak the size of a pinhead can waste enough air in a month to approximate the cost of a new valve. Steam leaks ... water leaks ... also take a heavy toll if neglected ... not to mention the wastage of such a critical item as fuel.

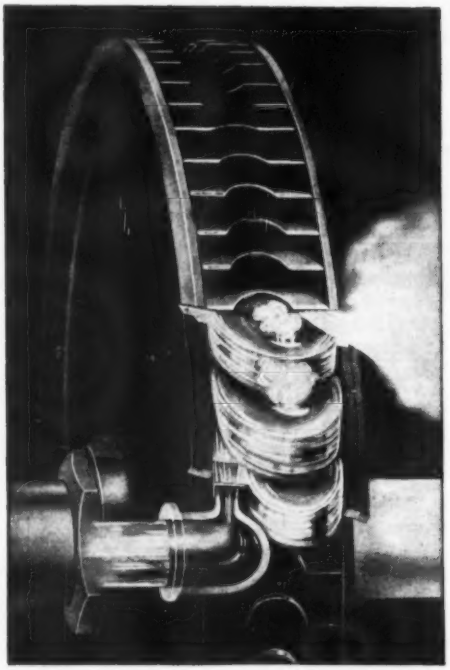
Where Lunkenheimer Valves are given ordinary care, such losses are held to an absolute minimum. These quality-built Valves are designed to give extra long service with the lowest possible outlay of time, labor, and money, for maintenance.

Enlarged copies of the above chart for posting in your plant are available on request. Also available are the services of your nearby Lunkenheimer Distributor, who is fully equipped to assist in solution of your operating or maintenance problems. The Lunkenheimer Co., Cincinnati 14, Ohio, U.S.A. (Branch Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7. Export Department: 318-322 Hudson St., New York 13, N. Y.)

R VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 to 2500 LB. S.P.; LUBRICATING DEVICES, BOILER MOUNTINGS, AIRCRAFT FITTINGS.

The TERRY



Action of steam in Terry Solid Wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket, in which its direction is reversed 180°. The steam is caught in a stationary reversing chamber and returned to the wheel. This process is repeated several times.

USES A SOLID STEEL ROTOR

The rotor of the Terry Wheel Turbine is made from a single forging of special composition steel. The semi-circular buckets or pockets are milled from the solid metal. The steps in the machining of a wheel are shown below. There are no parts to become loose or work out.

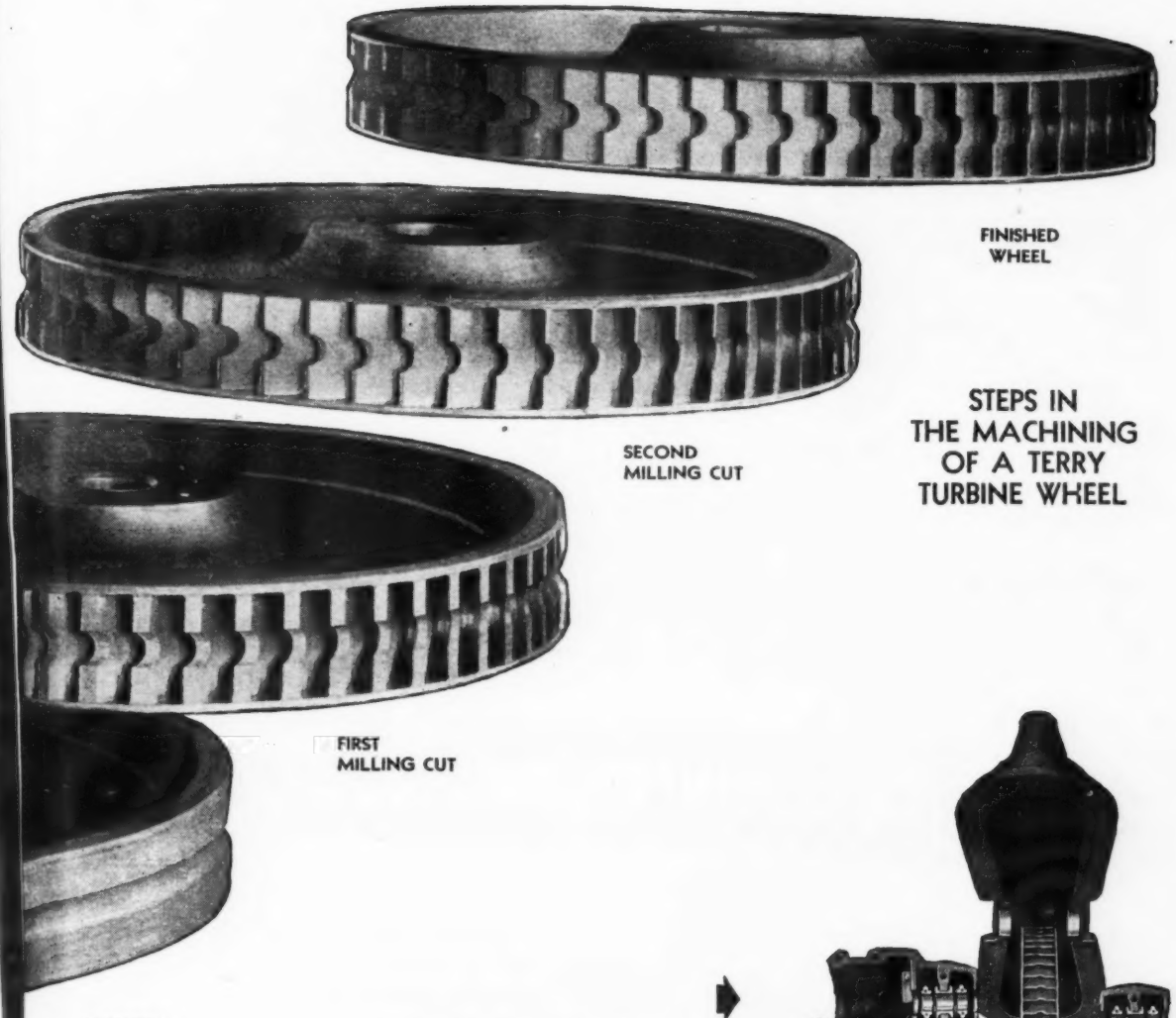
The power-producing action of the steam in the wheel buckets takes place entirely on the curved surface at the back of the bucket and therefore close blade clearance is not necessary.

As the only function of these blades is to form a series of pockets, wear of the blades is of little consequence and does not materially affect the horse power or efficiency. The important part of the bucket is the back or bottom, which is a solid forging.

FORGING — ROUGH TURNED

THE TERRY STEAM TURBINE CO.

Wheel Turbine



FINISHED WHEEL

SECOND MILLING CUT

FIRST MILLING CUT

SMOOTH TURNED

STEPS IN THE MACHINING OF A TERRY TURBINE WHEEL

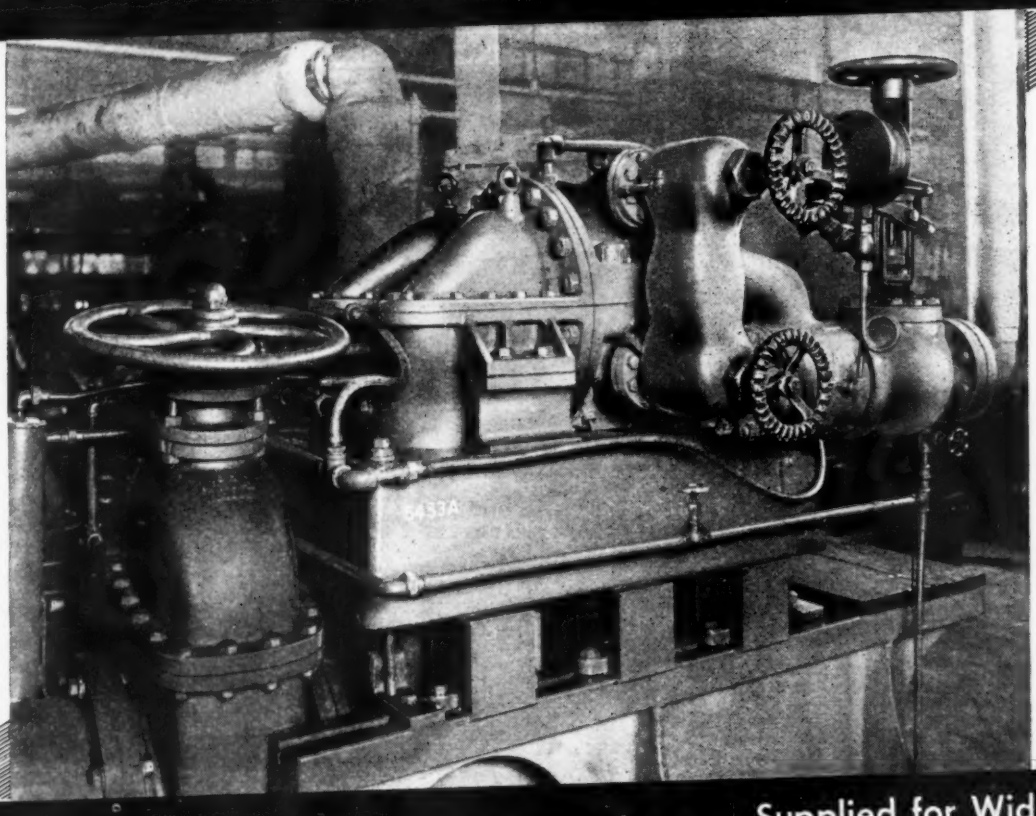
Typical Terry Solid Wheel Turbine with cover and bearing caps raised. Note the ruggedness and the accessibility of all parts. Units of this type are used to drive boiler feed pumps, generators, and all types of power plant equipment. Built in sizes from 5 H.P. to 2000 H.P.

FOR FULL DETAILS ASK FOR BULLETIN S-116

T-1156

TERRY SQUARE - HARTFORD, CONN.

THIS DE LAVAL UNIT COMPRESSES S-T-E-A-M



OTHER DE LAVAL COMPRESSORS Supplied for Wide Variety of Services

The above single-shaft, two-bearing steam turbine-driven compressor, operating at 25,000 r.p.m., compresses steam from 375 psi to 600 psi at a rate of 18,000 pounds per hour.

For services requiring increased steam pressure, when boilers for generating such pressure are not available, centrifugal compressors can be used to provide the increased pressure where the volume is sufficient.

De Laval builds centrifugal blowers and compressors for handling air, steam and other gases for a range of volumes up to and above 100,000 c.f.m., and for pressures up to and above 100 pounds per square inch, the maximum economical pressure depending upon the inlet volume and density.

De Laval compressor and blower specialists will gladly confer with you on any gas handling problems you may have.

3828

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON KANSAS CITY • LOS ANGELES • MONTREAL NEW ORLEANS • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

POWER

JUNE, 1945 VOLUME 89, NUMBER 6

N O WYNKOOP, *Publisher* P W SWAIN, *Editor*

Managing Editor: L N ROWLEY

Associate Editors:

F A ANNETT S A TUCKER E W FELLER

Assistant Editor: C F SANDERS *Art Editor:* E P DEMAREST

Business Manager: E J TANGERMAN

Washington: Paul Wooton *Los Angeles:* E J Strickland

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURES

- Wind-power studies suggest future commercial possibilities . . 64
- Wind-turbine power plant will be rebuilt 67
- Nitrous oxide meets low-temperature refrigeration needs 69
- Charts speed surface-condenser calculations 72
- Know steam-jet air ejectors and they'll serve you well 76
- DIESEL AND GAS-ENGINE FUELS AND COMBUSTION—a special section 79
  - How engines burn fuels 79
  - Gas-engine fuels 84
  - Diesel-engine fuels 86
  - Combustion chambers 89
- Hydroelectric power giants of the Pacific Northwest 95
- How to plot CO_2-excess-air curve for natural gas 99
- Mineral-free water without distillation 101

THE OPERATING ENGINEER

- Regrooving elevator sheave stops hoist-rope slippage 103
- Refrigeration notebook . . 105
- Practical aids 106
- Reader's problems 110
- Centrifugal pump Q & A 114
- Math tips 120
- 'How to—' 122

OTHER DEPARTMENTS

- What's new in equipment 124
- George Edwards 128
- Power news 130
- Data sheet 134
- New bulletins 186

VOLUME 89, NUMBER 6 • ABC • A McGRAW-HILL PUBLICATION • ABP •

COPYRIGHT 1945, By McGRAW-HILL PUBLISHING CO., INC.

James H McGraw, Founder and Honorary Chairman; James H McGraw Jr, President; Curtis W McGraw, Senior Vice-President and Treasurer; Howard Ehrlich, Vice-President (for business operations); John Abbink, Vice-President (for editorial operations); Joseph A Gerardi, Secretary; J S Blackburn, Jr, Director of Circulation • DISTRICT MANAGERS: New York, W W Quarles; Philadelphia, C R Long; Cleveland, F B Godley; Chicago, C Boughton; Boston, C L Morton; St Louis, G G Sears • PUBLICATION OFFICE: 99-129 N Broadway, Albany 1, N Y • EDITORIAL AND EXECUTIVE OFFICE: 330 W 42nd St, New York 18, N Y • Cable Address: "McGrawhill New York" • DISTRICT OFFICES: 520 N Michigan Ave, Chicago 11; 68 Post St, San Francisco 4; National Press Bldg, Washington 4; 16 S Broad St. Philadelphia 2; 738-9 Oliver Bldg, Pittsburgh 22; 1510 Hanna Bldg, Cleveland 15; 2980 Penobscot Bldg, Detroit 26; Continental Bldg, St. Louis 8; 1427 Statler Bldg, Boston 16; 1011 Rhodes-Haverty Bldg, Atlanta 3; Pacific Finance Bldg, Los Angeles 14, Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index. • POWER issues its own index annually.

SEE A *Link-Grate* STOKER ...Right in Your

YOU'LL SEE IN THIS MOVIE WHY THE LINK-GRATE STOKER GIVES THESE 10 ADVANTAGES

- Permits use of low-cost fuel
- Effectively handles all types of loads
- Assures accurate control of air flow
- Fuel bed flow is unrestricted
- Prevents formation of troublesome clinkers
- Ash discharge is continuous
- Provides high reserve capacity
- Keeps operating costs low
- Simplifies control
- Keeps installation cost low

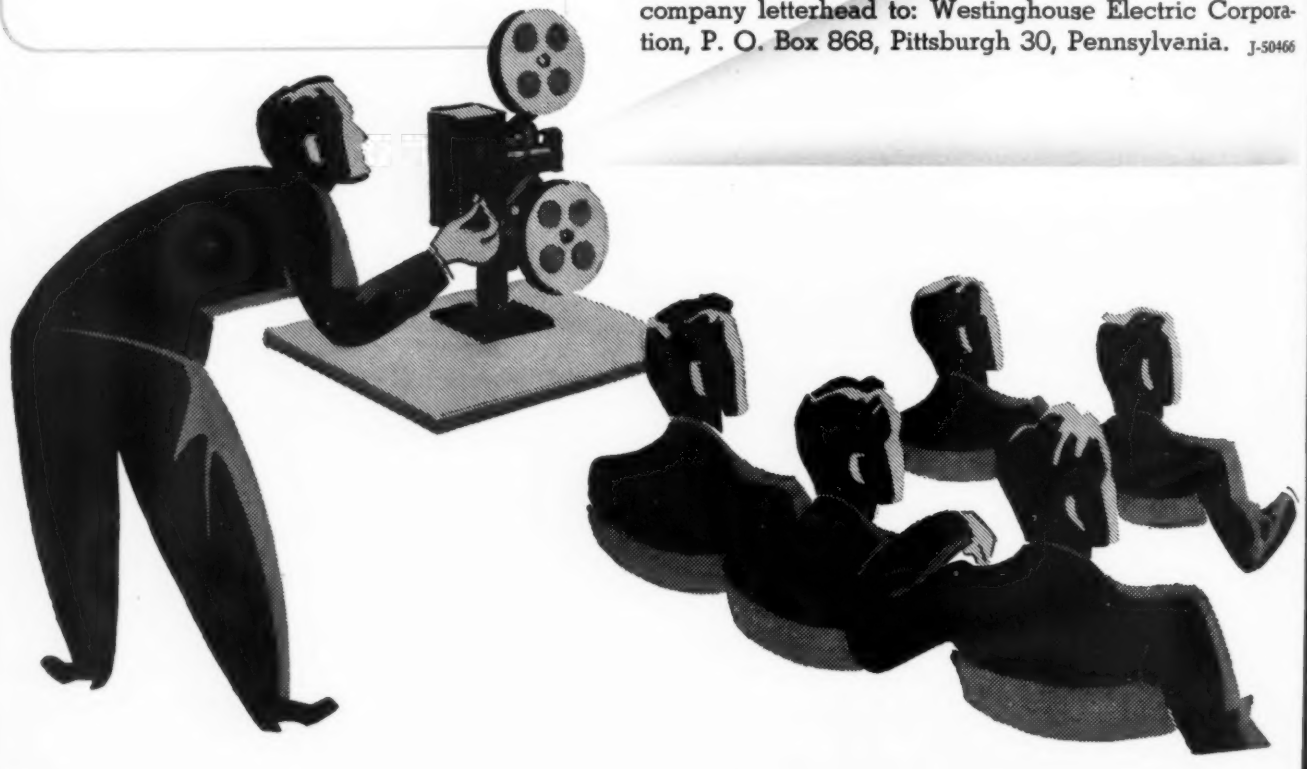
Of course, the best way to see the advantages of the Link-Grate Stoker is to visit a power plant and watch one in operation. But these are busy days. Time is precious.

To save your time, Westinghouse has produced a new fifteen-minute movie which lets you see a Link-Grate in action without leaving your office.

This new 16mm. sound film clearly shows why the wave-like motion of the Link-Grate means more steam per pound of coal and why you can use low-cost fuel. You can see how the upward motion of the Link-Grate breaks open the fuel bed to keep it porous and permit free air flow. You can watch the continuous ash discharge and see for yourself why the fire is always clean and active.

This new movie also illustrates simplicity of control and ability of the Link-Grate to handle all types of loads, and how it responds quickly to increased steam demands with full combustion efficiency.

Before you buy any stoker be sure to see this movie. Prints are available on loan for your private showing from your nearest Westinghouse office. Or write direct on your company letterhead to: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50466



DEMONSTRATION

Own Office

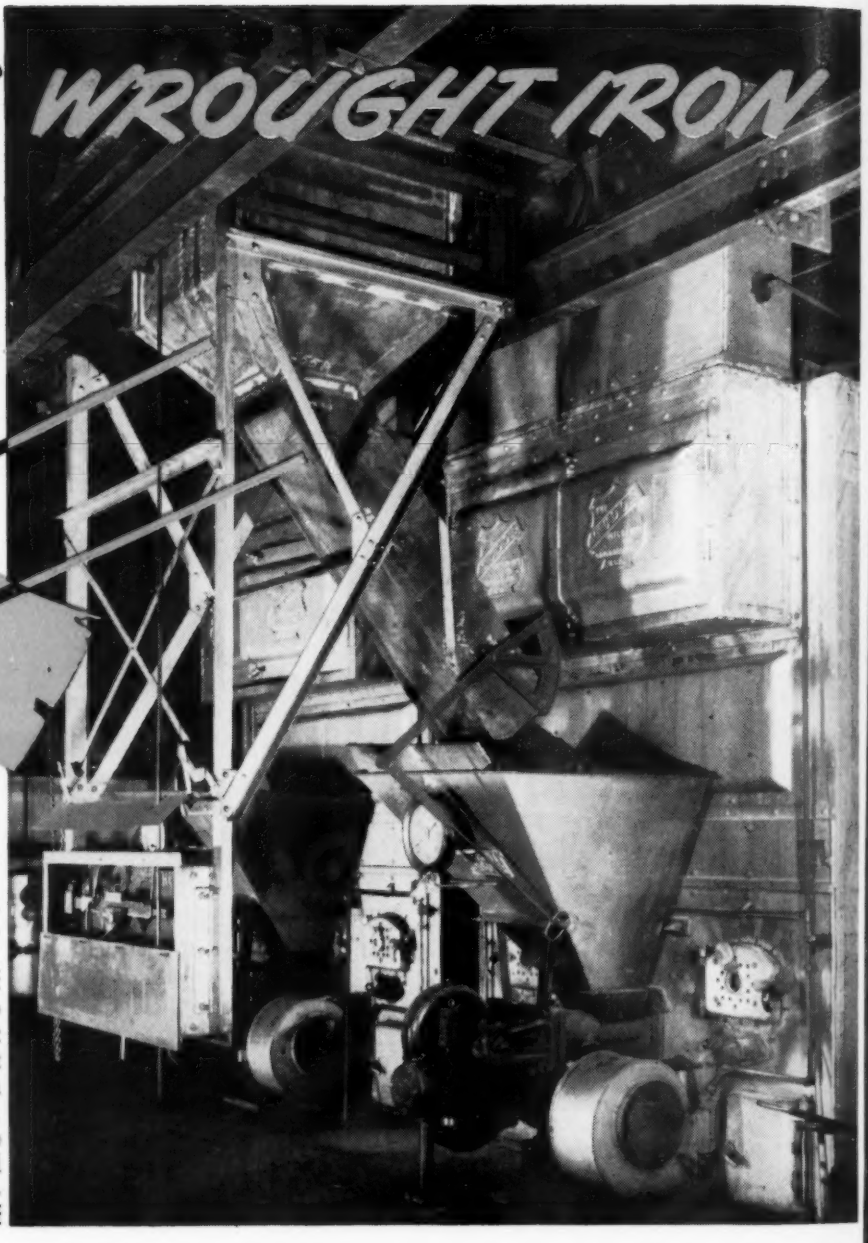
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Link-Grate STOKERS

BYERS WROUGHT IRON

installed Here to EXTEND HOPPER and CHUTE LIFE



This Coal Larry at the Cincinnati Times Star power plant was installed when the building was built. The hopper and chute—made of low first-cost materials—started to fail four years ago, but were kept in service until late 1944 by a lot of patching and repairing. Then the engineer, Mr. Charles Knorr, took steps to end the excessive maintenance. Following time-tried and time-proved practice, he installed a new hopper and chute of Byers Wrought Iron.

This same sound principle is followed by engineers in plants all over the country, who have used wrought iron for all varieties of coal handling equipment: coaling stations, bunkers, conveyors, chutes and larries. While abrasion is always a factor in service life, corrosion should always be anticipated and forestalled. The type of corrosion is similar to that occurring in smoke stacks, and is due to moisture leaching sulfur compounds from the fuel. The severity of attack is aggravated when operation is intermittent, and in such installations the protection afforded by wrought iron is doubly important.

Anyone familiar with the service conditions involved, and with the character of wrought iron, can readily understand why the material lasts longer. The tiny glass-like silicate slag fibers that are threaded through the body of high purity iron act almost like a picket fence, to halt and disperse the corrosive action. This discourages the pitting and penetration that generally causes ordinary materials to fail. Furthermore, the fibers help to anchor the initial protective film more firmly, and this film shields the underlying metal just as a scab protects a wound.

Some of the many installations of wrought iron in coal handling equipment are illustrated and described in our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." If you would like to review the subject, just write for a complimentary copy of this bulletin.

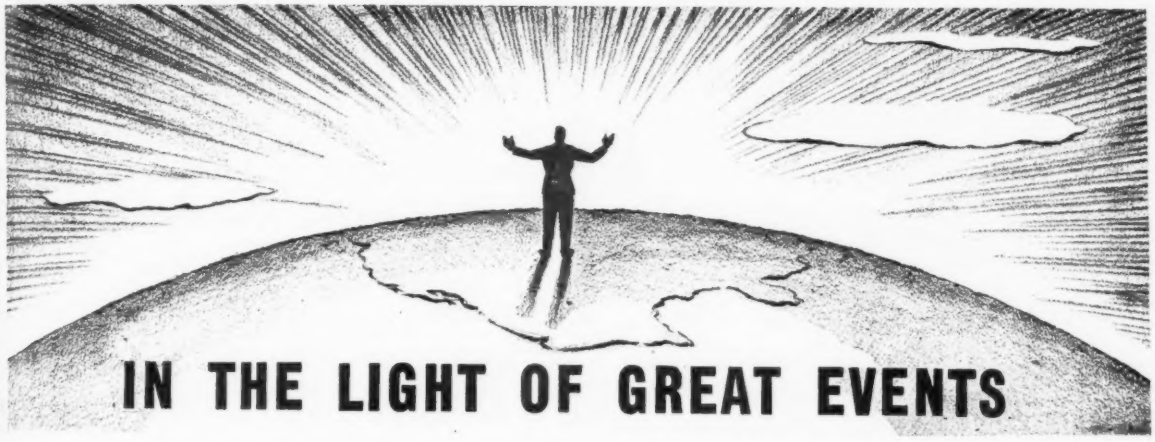
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • JUNE 1945 • ESTABLISHED IN 1882



IN THE LIGHT OF GREAT EVENTS

IN THE LIGHT of great events America moves ahead, her strength and high purpose revealed to all the world. Let's review these events briefly and without partisan bias.

Franklin D Roosevelt died. Harry Truman became President. The nations convened in San Francisco to build the framework of enduring peace. Germany went down in total defeat. With the Japan war still to be won, America started back on the road to normal industry and business.

These are the landmarks of current history. What do they mean for the future?

To millions here and abroad the untimely death of Mr Roosevelt came as a great shock. They felt that they had lost a beloved friend and the world a great leader. At the same time came ample proof that no single individual is essential to the life of the Republic. Nowhere was there any trace of panic, although questions of surpassing importance faced the new President, a man little known to the people at large.

Mr Truman's attitude and actions immediately inspired the whole nation. His humility won respect. His direct approach and spirit of cooperation instilled confidence. Thus he carries with him Congress and the people at a time when a united front is a priceless asset.

Not much can be said of the vitally important San Francisco conference at this writing, beyond stressing the will to constructive action so clearly displayed by most of the participants.

Germany's long expected defeat leaves two problems all Americans must face squarely: (1) How can we keep Germany from rebuilding military power for another war? (2) If we have a sound plan how can we guard against our own laxness in enforcing it?

The answers to these crucial German questions, worked out in the laboratory of battle-torn Europe, will show us more clearly how to wipe out the threat of future Japanese aggression in the Pacific area.

Meanwhile this remaining great war must be fought to the utter defeat of Japan. The generals and admirals will manage that, and we on the home front will give them every ship, gun, munition and supply item they can use for the great job.

That won't take more than half the industrial facilities we have been devoting to a two-hemisphere war. To insure continued high employment, and ease the growing strains on the civilian economy, production for non-military needs must take up the slack.

Many items of power-plant equipment will come back on the market in substantial quantities, bringing new problems and new opportunities to power engineers.

All industry will move rapidly toward a free market — toward the kind of business world where owners, managers and engineers must once more consider costs and production efficiency. This is the road back to a sound domestic economy and the kind of American life we are fighting for.

WIND-POWER FUTURE

Engineering studies made under the direction of the Federal Power Commission show that recent developments have brought large-scale electric power generation from the wind within our grasp. Designs for units up to 7500-kw on towers 500 ft high are suggested

► SUCCESSFUL OPERATION of the 1,000-kw Smith-Putnam wind-power plant on Grandpa's Knob, Vt., pioneered by S Morgan Smith Co (POWER, June, 1941) led the Federal Power Commission to survey wind-power possibilities in the United States. This survey was made principally by Percy H Thomas, a senior engineer in the office of the Commission's chief engineer, and has been directed primarily toward an examination of wind as an energy source and use of wind power in existing systems.

His investigation led Mr Thomas to study the design and construction of large wind turbines, and he has worked out the design of a twin-wheel aerogenerator that possesses unusual features. Recently the commission distributed a 72-page report by Mr Thomas, based on the results of his studies, from which this article is taken.

Because a large number of the best hydroelectric-power sites have been developed, particularly in industrial sections of the United States, it is desirable to study possibilities of wind as an energy source. Other large sections of the country, like the great-plains area between the Mississippi and Rocky Mountains, are relatively deficient in hydro sites and are not favored with large fuel resources for steam generation. These areas, however, have relatively constant winds of high average velocity.

Wind is available at velocities that permit its economical use at sites reasonably near load centers in nearly every section of the United States. Wind power is more universal than hydro, and its use requires only a relatively simple structure or mechanism adapted to automatic operations. Scientific progress, development of our great interconnected power systems and the lessons learned in producing the airplane have brought economical electric-power generation from the wind within our grasp.

Progress already made in the commercial use of wind is best shown by the Grandpa's Knob wind turbine on a mountain ridge a few miles west of Rutland, Vt. Mounted on a steel tower 110 ft high are the wind turbine and its electric generator. Able to turn in any direction to face the wind, the whole revolving structure weighs nearly 250 tons. Two blades weighing 7½ tons each sweep around a circle 175 ft in diameter, and with favorable wind are capable of delivering far more than 1000 kw. This installation is notable not only on account of its size, but because it delivered electric power regularly into utility lines (Central Vermont Public Service Corp), something never before accomplished. Unfortunately, the blades on this turbine were wrecked recently, but are to be rebuilt. see page 67.

Previous to the Grandpa's Knob installation, wind mills were of small capacity and restricted application and expensive compared to steam and hydro generating units. They were operated as isolated units and were unreliable because the wind is intermittent. Also, speed and voltage of wind-driven generators varied.

Builders of the equipment were not familiar with best design practices or the wind's behavior, and they generally believed that wind power could not be developed on a large scale. Also, practical utilization of wind-generated electric energy, considered in competition

STUDIES SUGGEST COMMERCIAL POSSIBILITIES

with present sources of wholesale power, depends in large measure on an interconnected utility network with hydroelectric storage being available to pick up the load when the wind fails temporarily. These conditions have been greatly improved.

Use of the wind for power requires a detailed knowledge of the wind's action on turbine blades. Studies incident to the development of the airplane have developed this knowledge. Other difficulties such as wind intermittency, varying turbine speed, and unit sizes can be readily solved now that the aerodynamic problems are understood.

Mr Thomas' study of the wind's characteristics leads him to state that "While no final conclusion is drawn, the evidence points strongly to the wind as a consistent and reliable power source as long as variations of supply within the month are equalized. As a matter of comparison it appears that both in degree of variation and length of period of deficiency, wind power probably has a marked advantage over waterpower, which may be affected both by dry seasons and by dry years."

Wind-Power Limits

Capacity from wind power in utility systems has limitations, shared by run-of-river hydro power. Continuous capacity beyond the minimum diversity capacity can be obtained only by energy storage. Water-storage reservoirs combined with hydroelectric plants are the only practical storage to firm wind power. Studies by Mr Thomas indicate that wind deficiencies are so short and in general of such a character that the amount of water storage required to firm wind power comes well below that available in many of our mixed power systems. Reservoirs of capacity too small to be useful as seasonal storage may be adequate for equalizing considerable amounts of wind power.

To bring out the mechanical problems involved in a wind turbine, the type of structure required and an adequate basis for making construction-cost estimates, Mr Thomas designed a workable aerogenerator unit, including all necessary features. The design was carried to the point of calculating stresses for all essential members in the structure, tower, bridge, wheels and mechanical equipment.

In this undertaking it was necessary to do some pioneering, as no design beyond the 1,000-kw unit on Grandpa's Knob was available. It was concluded that no unit of less than 5,000 to 10,000 kw would give satisfactory information in exploratory surveys for utility work. A 7500-kw twin-wheel layout was therefore first chosen. In this layout a turbine wheel is mounted on each end of a 200-ft bridge that can rotate on top of a high tower. Airplane propeller blades are used with two blades per wheel. The two turbine wheels connect through speed-up bevel gears to a single variable-speed dc generator, Fig. 2. Because of the advantages of high wind velocity and beneficial effect of altitude, the wheel shaft was placed 475 ft above ground. A tower for this elevation can be economically designed with long self-supporting spar-like members if given a sufficiently wide base. This type of tower is a significant departure from the 110-ft Grandpa's Knob construction.

It was found that this layout gave ample space at the center of the bridge above the tower for an adequate generating room for the electrical equipment and auxiliaries, Fig. 1. With a maximum wheel speed of 42.75 rpm, and a 34-mph maximum wind velocity the delivered capacity was found to be 7.700 kw. This value is subject to check by tests when similar units are built.

(*Continued on page* 66)

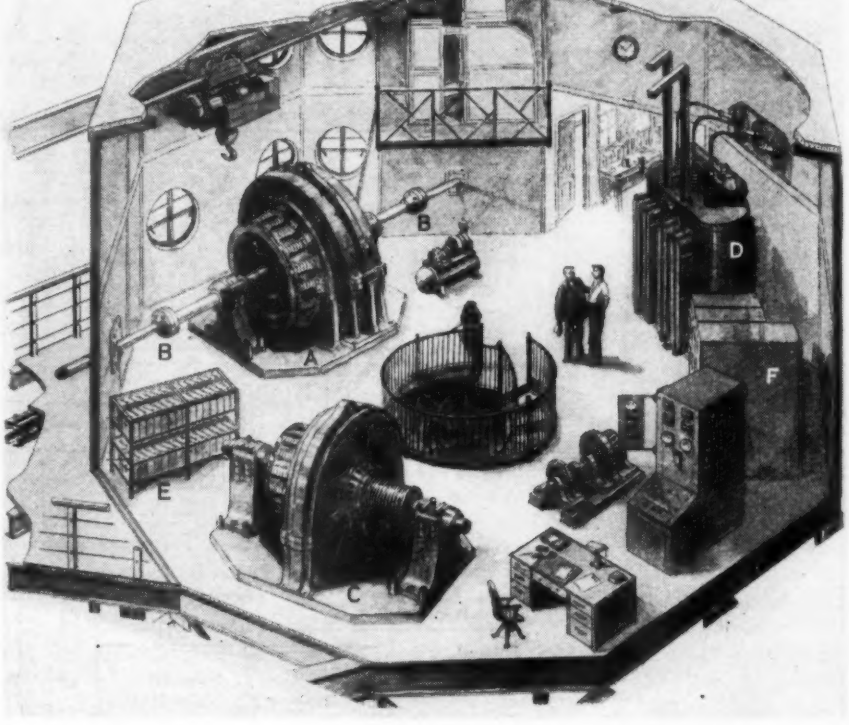


Fig. 1—Inside the proposed power house at center of bridge (see opposite page) two turbines connect to a 6500-kw variable speed dc generator. *Legend: A*—Variable-speed dc generator; *B*—Drive shaft from wind turbines; *C*—Rotary converter; *D*—Main stepup power transformer; *E*—Storage battery; *F*—Cubicle switchboard

To reconcile the varying velocity of the wind and speed of the turbine with the constant frequency of the utility circuit, the wheels drive a direct-current generator with a speed range between full value and 40%. The dc power is transformed into ac by a rotary converter which runs in synchronism with the ac utility circuit. With the converter and wind-turbine speeds independent of each other only the turbine load and thus its speed has to be controlled. Wheel speed and generator field strength determine generator voltage. Converter voltage is fixed by that of the utility system and the transformer ratio. Load on the wheel is then controlled by automatically adjusting generator field and transformer ratio to obtain wheel speed and energy flow appropriate to any existing wind velocity.

The 7500-kw generator was designed for a site where average available wind has a velocity of 23 to 25 mph. comparable with the Grandpa's Knob design. Since there are many locations where the average wind velocity is well below this value, Mr Thomas made a second design, shown in the headpiece, adapted to wind velocities of from 18 to 21 mph. This design uses the same tower and same diameter wheel, but varies in other respects from the larger unit. It has a rated capacity of 6500 kw with a 28-mph wind, the maximum velocity for normal or proportional wheel-speed operation.

While it is not practical to determine exact construction costs for wind aerogenerators at this time, Mr Thomas attempted to provide a reliable estimate. To eliminate uncertainty and excessive cost of first installations and untried designs, but include normal contractor's profits, Mr Thomas based his cost estimate on a contract for ten units erected on two or three sites and as one operation. It was further assumed that the physical design was thoroughly established by experience so that its mechanical and electrical characteristics were understood. The resulting estimate was $68 per kw including all indirect and overhead expenses and insurance, based on 7500-kw units for a 34-mph wind. Estimates for the 6500-kw unit and 28-mph wind were $75 per kw.

In his conclusions Mr Thomas states:

"The high value of wind power for general utility supply and the feasibility of its utilization seem reasonably clear. The wind offers the cheapest energy and should be used in connection with steam and hydro prime movers, with which it forms a most favorable combination. In a system with some moderate seasonal storage, supported by a certain proportion of hydro capacity, taken over and above the very-dry-time system assured capacity, the energy extracted from the wind is able to support an amount of firm capacity on any particular load curve appropriate to the amount of that energy, just as with run-of-river hydro energy of the same pattern.

"The wind with all its daily variations is, as measured by monthly averages, surprisingly stable and a reliable source of energy.

"The wind power turbo-generator as a unit involves many novel features, but presents no mechanical or electrical problems offering any really serious obstacles. There is a most urgent need for the collection of certain wind performance data on actual sites known to be favorable for wind turbines, to permit the proper design of units. Especially as its economic value, in competition with efficient steam plants, depends as far as can be seen on the reasonable availability of sites with average wind velocities in the order of 18 to 20 mph."

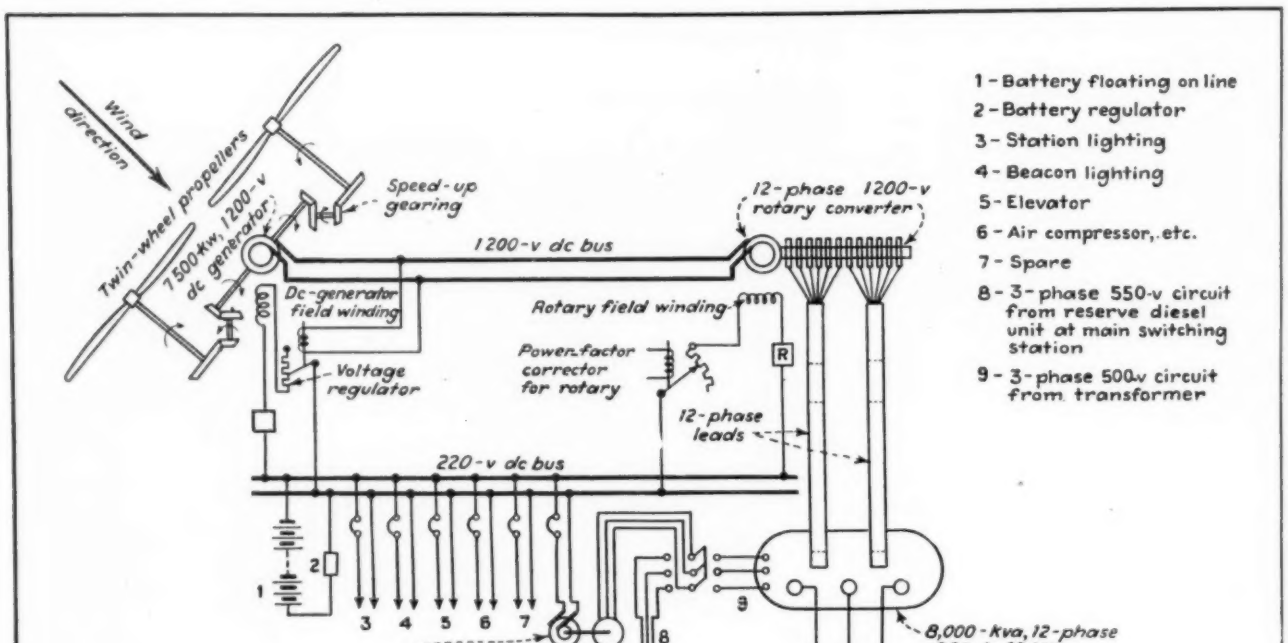


Fig. 2—Diagram shows general arrangement of 6500-kw electric wind-power generating plant and auxiliary equipment. Two wind turbines gear to single variable-speed dc generator connected to a rotary converter and to a stepup transformer

Wind-Turbine Power Plant Will Be Rebuilt

What happened when one blade, 65 ft long and weighing 15,300 lb, came off the wind-turbine power plant atop a 110-ft structural-steel tower built on a Vermont mountain. Performance of the turbine prior to the accident, causes of the failure and rebuilding the turbine are discussed in this statement by P C Putnam, the chief consultant on this project

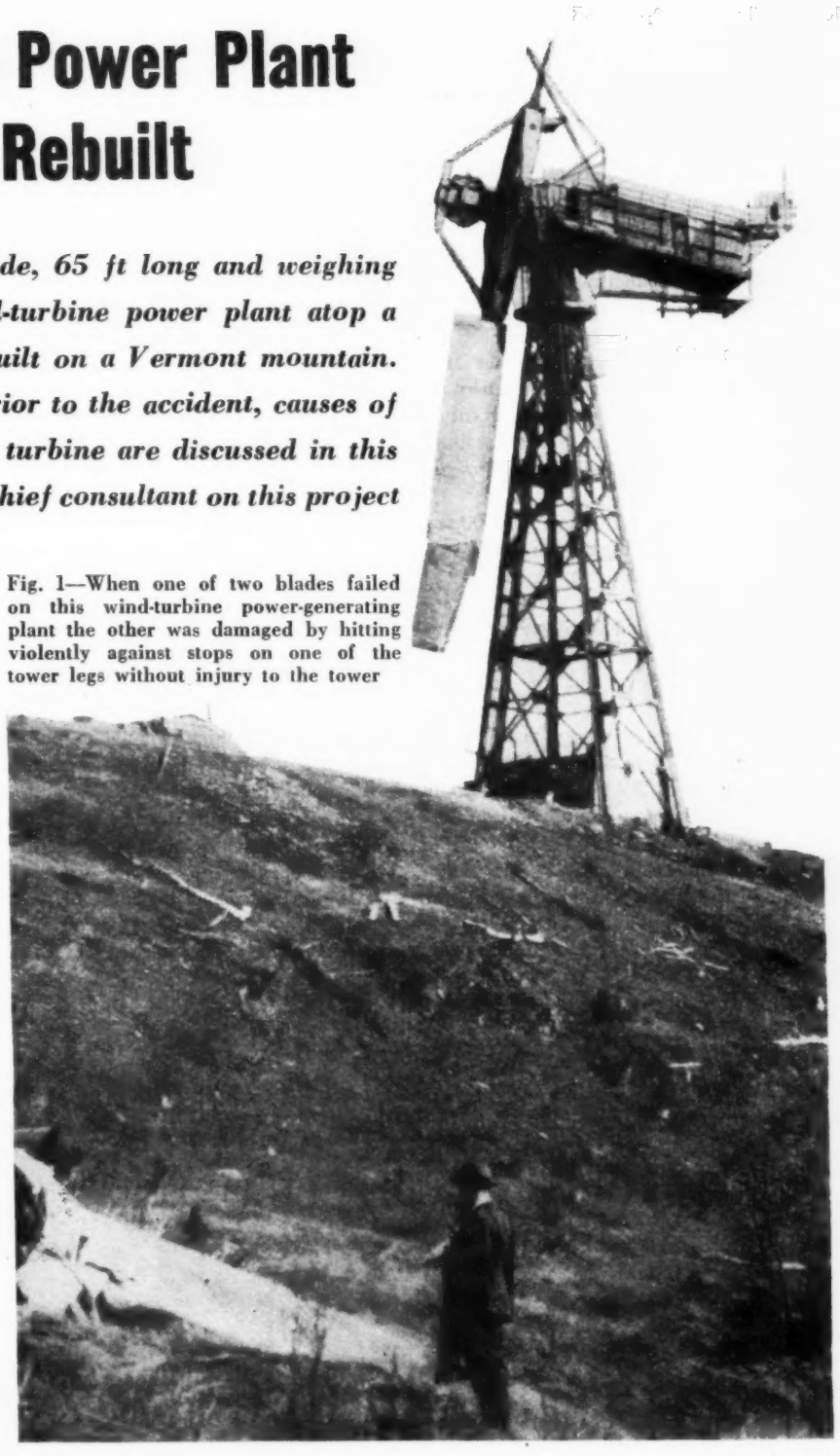


Fig. 1—When one of two blades failed on this wind-turbine power-generating plant the other was damaged by hitting violently against stops on one of the tower legs without injury to the tower

▶On March 26, following three weeks of satisfactory operation after installation of a new bearing and other improvements, one of the two blades failed on the 1000-kw experimental wind turbine on Grandpa's Knob, a Vermont mountain. During the three and a half years since the unit first went into operation it had withstood the worst in wind and ice that mountain storms can deliver. At the time of the accident however, wind velocity was only 20 miles per hour. The wrecked blade, 65 ft long and weighing 15,300 lb, landed about 1000 ft away on the mountain side, Fig. 1. The structural-steel tower and other parts supporting the unit stood the shock admirably.

After the accident, POWER asked S Morgan-Smith Co, sponsor of this great research project, for a statement on the wind turbine's performance, the cause of the accident and plans for rebuilding the unit. P C Putnam, chief consultant, wind-power division of the company, supplied the following engineering details:

Putnam Report

"At 3:10 am on the morning of March 26, 1945, in a smooth southwest wind of 20 miles per hour, the Smith-Putnam wind-turbine test unit on Grandpa's Knob, near Rutland, Vt., was rounding out the first month of routine operation as a generating station when one of its blades failed. The operator on duty aloft heard nothing, but suddenly felt considerable motion and, working his way against this to the control panel, made a quick manual shut-down in about 2 or 3 sec. Fifteen seconds may have elapsed after the operator first felt motion, before he brought the turbine to rest. During this time the turbine completed six or seven revolutions with only one blade remaining attached.

"Inspection showed that the blade spar had failed along multiple and corroded cracks at the outboard edge of the bolted shank spar connection, Fig. 2. We do not know the age of the corrosion.

"Visual damage to the standing structure appears to be confined to the leading edge of the remaining blade, which coned negatively and violently into one of the stops on the tower legs but without damaging tower, Fig. 1. Subsequent inspection showed similar corroded cracks well developed at the same point in the remaining blade spar.

"Measurements indicate that neither the main shaft nor the pintle shaft is sprung. Nevertheless, the very high unbalanced forces may have caused damage not yet visible, so the unit will be disassembled to the tower cap to permit a thorough inspection.

"Without being able to evaluate them, we can list the following contributing causes of the failure:

"A. Stress concentrations were pre-

sumably produced at the point of failure, because of an abrupt change of section in the box spar, and also due to the presence of a bulkhead at this location.

"B. During the course of some field modifications in July, 1942, both the blade skin over the root area, and the bulkhead located at the point of stress concentrations mentioned in A, were stiffened, tending to accentuate the stresses at this section.

"C. At the same time, acute additional stress concentrations at this point were caused by the notch effect of an undercut field weld, fastening the bulkhead to the four outside plates of the box spar.

"D. Some fatigue due to 1,500,000 revolutions of the turbine, with stress variations (but not complete reversal) in each revolution.

"Design studies and early tests under the supervision of Den-Hartog indicated that flutter was not present in the blades.

"The unit first went on test Oct 19, 1941, and remained so for a little over a year until Feb 20, 1943, during which time it had been operated on the line a total of 695 hr, and 192 hr off the line on test, generating a total of 298,240 kwhr. During this period, the unit was pretty well 'debugged'.

"At the end of this period the bearing (24.8-in. bore) failed at the downwind end of the inclined main shaft. No spare was in stock. Because of priorities, the bearing could not be replaced until Mar 3, 1945. During this outage, various improvements were incorporated in the unit. On Mar 3, it was put back on the line and, for the first time, began operating as a routine generating station on the power system of the Central Vermont Public Service Corp, without interruptions for testing.

"Between Mar 3, and 26, 1945, the unit operated 143 hr and generated 61,780 kwhr. This period was an unusually windless three weeks for March.

"Thus, at the time of the accident, the unit had operated 838 hours on the line for power generation and 192 hours off the line for testing and had generated a total of 360,000 kwhr, an average load of 430 kw.

Future Wind Power

"Because of our experience with the test unit, from which we have gained increased knowledge of the actual forces acting on various parts of the structure, we can now design much closer to the actual requirements than was possible when designing the present test unit. We believe we can design and build wind turbines that will be entirely practical for continuous operation on power systems and within the limits of safety obtained with other forms of prime movers.

"Advantage will be taken of the disassembly to reflect in the rebuilding lessons learned during the three years of the test program and, more particularly, the lessons learned from the studies of this accident."

One of the factors contributing to the belief of all concerned that the project has a vigorous post-war future, is the receipt of some 200 serious inquiries from all quarters of the world during the past three years. The rate of receipt has shown an increase from year to year.

REBUILDING OF THE UNIT IS UNDER WAY.

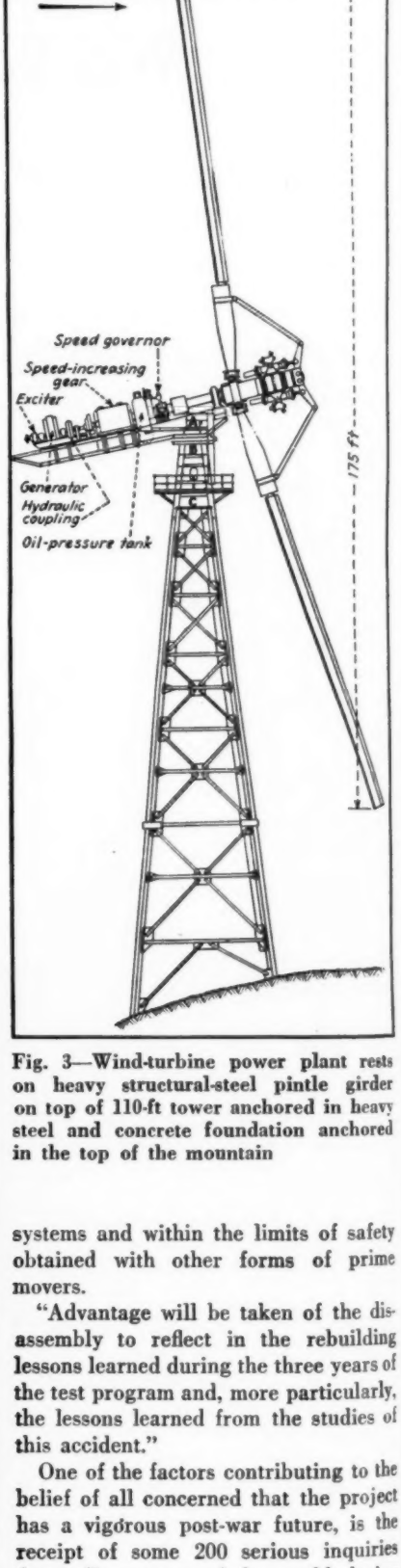


Fig. 3—Wind-turbine power plant rests on heavy structural-steel pintle girder on top of 110-ft tower anchored in heavy steel and concrete foundation anchored in the top of the mountain

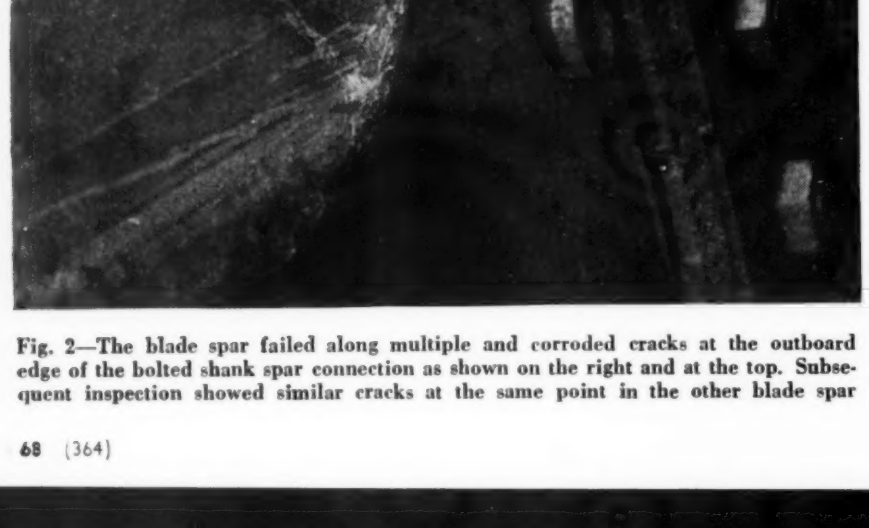


Fig. 2—The blade spar failed along multiple and corroded cracks at the outboard edge of the bolted shank spar connection as shown on the right and at the top. Subsequent inspection showed similar cracks at the same point in the other blade spar

Nitrous Oxide Meets Low-Temperature Refrigeration Requirements

Until recently nitrous oxide was not considered a useful refrigerant because of its supposedly bad characteristics. Tests dispel doubts and prove this compound almost ideally suited as a refrigerant for low-temperature applications

By A I McFARLAN
Vice-President, Kerby Saunders, Inc

▶While investigating a rather unusual low-temperature refrigeration problem, we found that presently known refrigerants would be unsatisfactory but, for the particular use under consideration, nitrous oxide possessed sufficient possibilities to merit consideration. Although it offered certain refrigerating advantages, nitrous oxide has characteristics that, from the meager data then available, pointed to it as a bad actor when used for this purpose.

For instance: (1) Feeling was almost universal that corrosion would be a major problem because it occurs in compressors used to manufacture the liquid. Here the gas is compressed immediately after leaving the scrubber, and water is used as a compressor lubricant. If water were causing the corrosion we should experience no trouble because, for refrigeration, the gas must be almost perfectly dry or the expansion valves would freeze. (2) Compressor lubrication also presented difficulties. Although nitrous oxide is non-explosive, it supports combustion (like oxygen) so precautions had to be taken to prevent ignition of oil or other volatile matter in the compressor cylinder. (3) Definite information was not available as to the possibility of the gas breaking down into its higher oxides.

Because of an almost complete lack of data and operating experience, and the urgent need for reasonably accurate information in the shortest possible time, we built a pilot plant to test our theories. Only in this way could we determine the operating characteristics of nitrous oxide.

Danger of serious compressor corrosion dictated using stainless-steel cylinder liner, piston, piston rings and valves. If we could have secured a compressor fitted with these alloy-steel parts within the allotted time it is doubtful if we would have learned the true facts about corrosion. However, delivery time was indefinite and, since the compressor was to be used only a few months, we reluctantly decided to accept a standard cast-iron cylinder with stainless-steel valves.

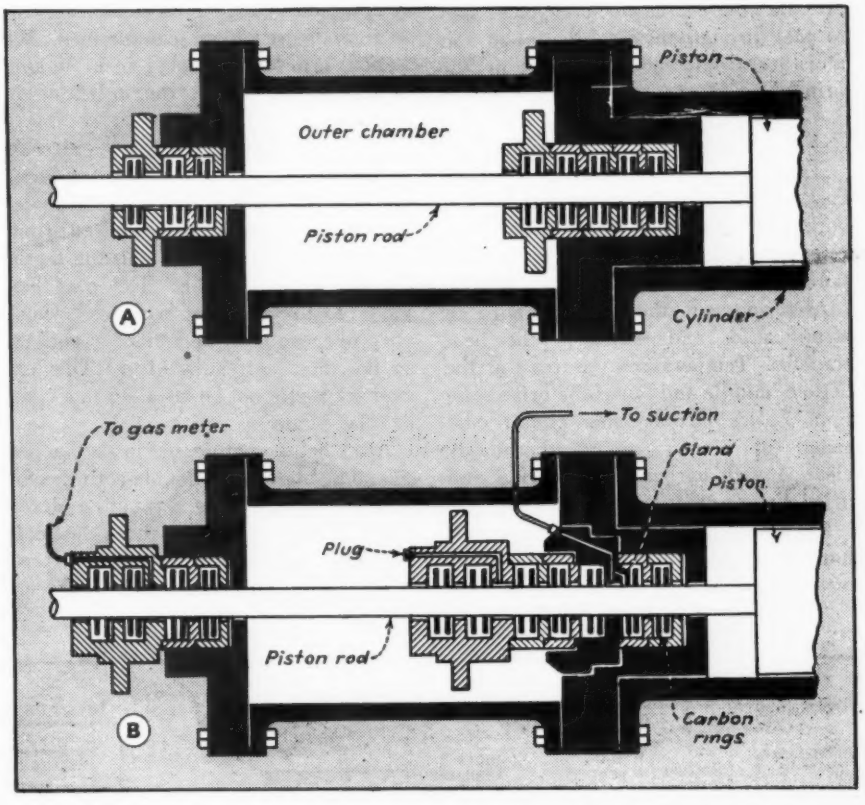


Fig. 1—Compressor originally had 16 cargon piston-rod packing rings, *A*. It was later found advisable to add six more rings and a bleedoff line to the suction, *B*

The question of cylinder lubrication was given much study. Final answer was to use carbon piston rings and install carbon packing on the piston rod. Thus oil or other volatile matter need not enter the cylinder. Compressor packing gland was built with an outer chamber and a second stuffing box, Fig. 1A. A bleeder line and valve, connecting the compressor suction line to the space between the second and third rings from the cylinder end of the first stuffing box, permitted varying the pressure at this point from maximum down to suction pressure. A line from midpoint of the outer gland connected to a meter which measured leakage at that point.

With this arrangement, and regardless of suction pressure, bypass pressure could be momentarily regulated to a predetermined amount and the leakage measured. Actual leakage was somewhat less than that measured since the

two additional rings beyond the meter tap obstruct free passage.

The cycle finally adopted for the pilot plant, Fig. 2, was influenced by materials available and the particular requirements of the job involved. It is not proposed as the best arrangement for using nitrous oxide as a refrigerant, even for the temperature involved, but it did furnish pertinent data for our purpose.

The nitrous-oxide evaporator coils (copper) were immersed in a copper-lined tank filled with isoprophylbenzene (cumene) brine. Several 25-kw calrod electric heaters, with automatic control set to cut them out if brine temperature reached 75 F, completed the calorimeter for loading the evaporator. Atmospheric air that entered the brine chamber had to pass through chemical dryers so that moisture would not condense in the brine.

Calorimeter Insulation

Tank insulation consisted of 16 in. of cork board and sufficient granulated cork to fill the corners of a square box retainer. An agitator supported on the tank top maintained uniform temperature throughout the brine, eliminated stratification and increased the heat transfer. Temperature was read at the bottom, middle and top of the brine solution. Entire nitrous-oxide circuit consisted of copper piping thoroughly cleaned with carbon tetrachloride and dried before erection.

An orifice placed in the refrigerant line connected to a mercury U-tube that measured flow through the system. We later found it necessary to insert an orifice in the gas line to check liquid meter readings. Measuring the suction gas was found to be a more accurate way to determine flow.

Temperatures were measured by thermocouples and potentiometers at points *T* and pressures at points *P*. All indicators were mounted on a common board so that simultaneous readings could be taken throughout the cycle. Resulting temperature, pressure and displacement values checked fairly closely with predicted figures and system performance deviated only slightly from that expected. On the first day of operation we obtained a temperature of −90 F within eight hours after starting.

The pressure-enthalpy diagram, Fig. 3, designed by us, served as the basis for a great many of our calculations. We believe it to be reasonably accurate and, as far as we know, the only one in existence.

To follow the cycle in Fig. 2, nitrous-oxide suction gas leaves the evaporator coil and passes through a liquid cooler where its temperature is raised from −109 to −50 F while it cools the liquid from −43 to −72 F. The gas then passes to a second heat exchanger whose only purpose is to add more superheat so its effect can be studied. This exchanger would not be installed in a commercial plant.

After being compressed in the 5x6-in. 300-rpm single-stage double-acting compressor the gas goes through a dryer (subsequently removed) and a dust collector on its way to the condenser. Here it is cooled and condensed by Freon before entering the receiver. Completing the cycle, the liquid flows through a dryer, filter and liquid cooler to the expansion valve where it again enters the evaporator coils. Dust collector removes any carbon particles thrown off by the piston rings.

Freon part of the cycle consists of a conventional 2-stage system that condenses the nitrous oxide at −43 F with −55 F Freon. City water condenses the Freon. Only unusual feature is the liquid Freon bypass going to the nitrous-oxide suction-gas heat exchanger. As explained previously, this connection was made only to study the effect of superheating the nitrous-oxide gas.

Results of Test

Results of this development can be summarized as follows:

1. Nitrous oxide is a workable and useful refrigerant *if its limitations are respected.* From the safety angle it equals the best of present refrigerants for temperatures between −70 and −120 F.

2. Used dry, nitrous oxide is noncorrosive. Quoting from the metallurgist's report: "Based upon a microscopic examination of the compressor surfaces, no severe changes occurred. Aside from the normally expected evidence of operation, such as a slight score and general surface dulling, apparently little change has taken place."

3. Rather complete thermodynamic physical properties of nitrous oxide were prepared and checked.

4. Compression data were secured

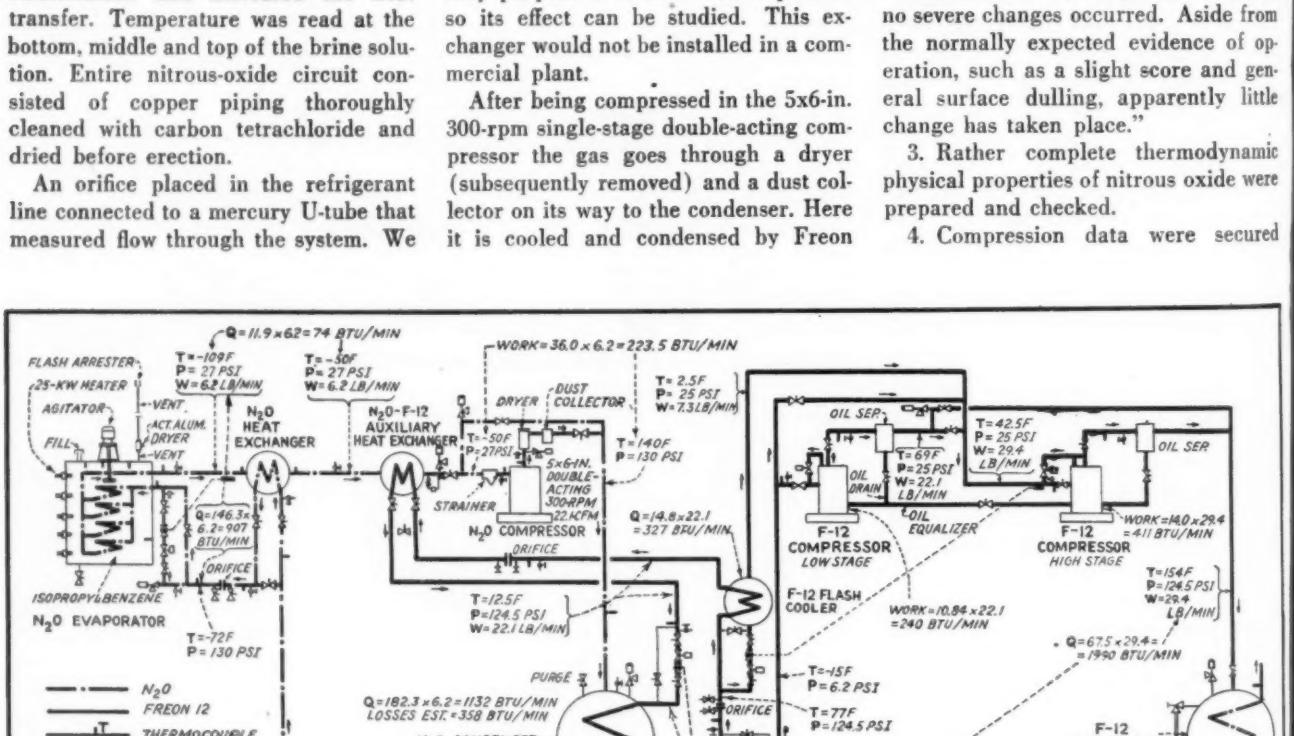


Fig. 2—Flow diagram of the pilot plant erected to study nitrous-oxide performance as a low-temperature refrigerant. The circuit was cascaded with a 2-stage Freon-12 system that cooled and condensed the nitrous-oxide gas for recirculation

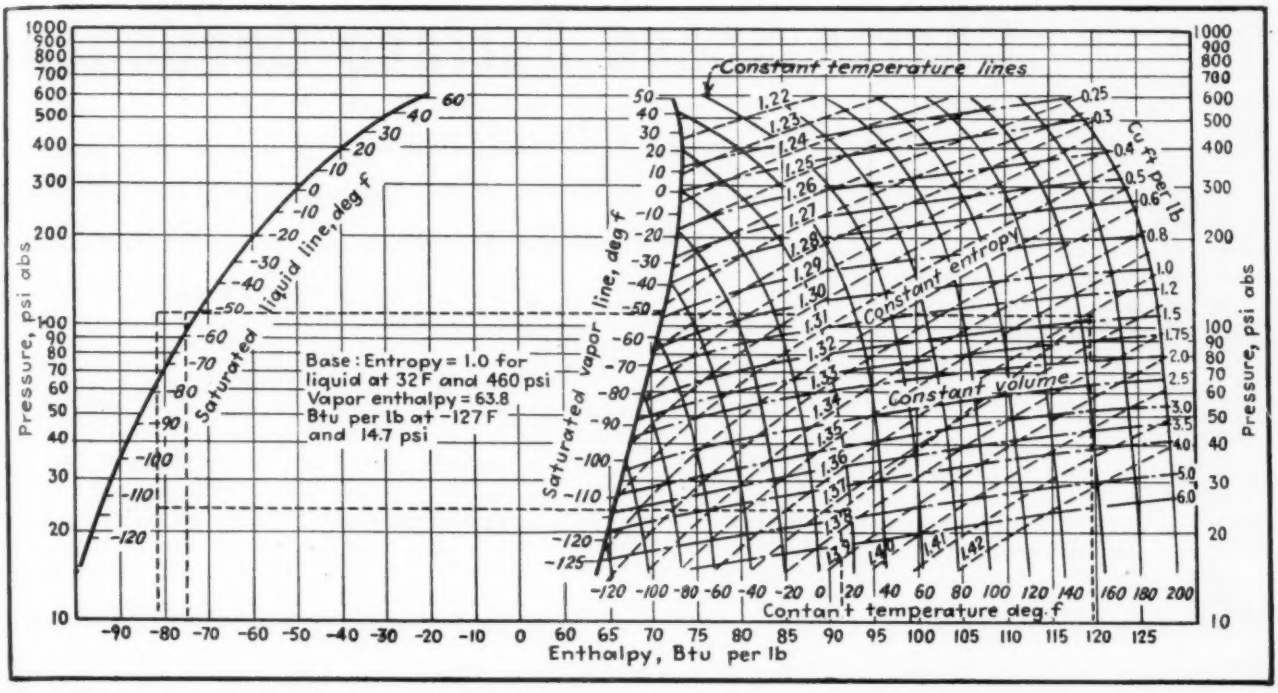

Constant temperature lines
Saturated liquid line, deg f
Saturated vapor line, deg f
Constant entropy
Constant volume
Cu ft per lb
Base: Entropy = 1.0 for liquid at 32 F and 460 psi
Vapor enthalpy = 63.8 Btu per lb at −127 F and 14.7 psi
Pressure, psi abs
Enthalpy, Btu per lb
Constant temperature deg f

Fig. 3—The pressure-enthalpy diagram designed to the entropy base 1.0, for liquid at 32 F and 460 psi abs, served as the basis for many of our calculations. It is reasonably accurate and the only one in existence as far as we can determine

and expected volumetric efficiencies determined.

5. A satisfactory compressor design was developed.

6. Moisture control is necessary to prevent expansion valve freezing. Therefore gas dewpoint readings were taken and when the dewpoint rose above −60 F the drying material was reactivated. This was necessary only a few times during the test.

7. Maintaining sub-cooled liquid ahead of the expansion valve is important.

8. Nitrous oxide is stable. Tests made over a period of several months indicated no disintegration whatsoever.

One point appreciated by anyone who has had experience with low-temperature plants is the desirability of operating at a positive suction pressure. Thus leakage is outward, instead of inward with its resulting air accumulation inside the system.

Several common refrigerants have this characteristic but as far as we know nitrous oxide is the only relatively safe refrigerant operating above atmospheric pressure for temperatures of −120 F. A manufacturer of this material says that his largest users are bakers who extrude frosting on fancy cakes and pastries with the gas. So we now eat a lot of food that has been in contact with nitrous oxide. It is tasteless, odorless and nontoxic.

Compared with ammonia, Freon and other refrigerants operating under vacuum for low temperatures, compressor displacement needed for nitrous oxide is much smaller. Compared with many presently operating low-temperature plants, nitrous oxide offers the same results with 5 to 10% of the compressor displacement. This figure was obtained with a maximum discharge pressure of about 200 psig using a single-stage nitrous-oxide cycle cascaded with another refrigerant.

Within the limits of 1-to-80-psig suction and 100-to-200-psig discharge pressure, standard gas compressor designs can be used for nitrous oxide with minor changes to the piston rings and stuffing box. Combined with the greatly reduced displacement required, this results in a considerable saving in compressor first cost as well as operating cost of the necessary driving power.

N_2O Compared to Freon 12

Comparing nitrous oxide with Freon 12 at −100 F:

Nitrous oxide	*Enthalpy*
Sat vapor, 2.4 cu ft/lb..	67 Btu/lb
Sat liquid.....	−89 " "
Difference	156 Btu/lb

Freon 12	*Enthalpy*
Sat vapor, 22.4 cu ft/lb.	66.4 Btu/lb
Sat liquid.....	−12.6 " "
Difference	79.0 Btu/lb

Relative compressor displacement =

$$\frac{2.4}{22.4} \times \frac{79.0}{156} = 0.054, \text{ or } 5\%$$

We consistently produced temperatures in the vicinity of −100 F, condensing at about −40 F, with an average measured input of 1 kw per ton on the nitrous-oxide compressor motor. This was with a load varying from two to three tons, and is considered excellent performance. Nitrous oxide should take its rightful place as a low-temperature refrigerant in the near future.

Here are the characteristics of nitrous oxide:

1. Not an irritant
2. Not inflammable
3. Not explosive
4. Supports combustion
5. Condensing pressure at −20 F, 200 psi abs
6. Evaporating pressure at −120 F, 19 psi abs
7. Boiling point at atmospheric pressure, −127 F
8. Freezing point at atmospheric pressure, −128 F
9. Triple point at atmospheric pressure, −132 F
10. Critical temperature, 96.5 F at 1050 psi abs
11. Net refrigerating effect at −100 F, 156 Btu/lb
12. Amount handled at −100 F, 1.28 lb/min/ton
13. Piston displacement at −100 F, 3.07 cfm/ton
14. Reaction with oil: If oil ignites, nitrous oxide supports combustion
15. Miscible with oil: not tested
16. Not corrosive to metals (alone)
17. Corrosive to metals (with water)
18. Food is not spoiled by exposure to nitrous oxide

The special heat exchangers installed in the pilot plant for this test were supplied by the J C Mahoney Corp.

Charts Speed Surface-Condenser

Whether the problem is selection of a new condenser or checking performance of an existing unit, these charts and accompanying outline of calculating procedure relate the variable quantities quickly and with reasonable accuracy

► Many variables enter into the design of a surface condenser, each of which requires consideration in the selection of proper unit size for a given turbine-generator. Of course in the long run a more or less complete economic analysis should determine the optimum size of any apparatus. The extent to which this analysis is undertaken depends on magnitude of expected savings in operating and investment cost.

For a condenser, this economic analysis involves many variables such as water flow, surface area, water velocity, tube size, tube length, number of passes, steam flow, vacuum, inlet-water temperature and cleanliness ratio. By methods outlined here, this tedious task can be simplified by eliminating some of the variables; a series of condenser sizes can be set up quickly from which the optimum can be selected.

For fixed surface and circulating water flow, vacuum produced is a function of inlet-water temperature and the net heat rejection. One of the most satisfactory methods of solving a problem of condenser equilibrium is to calculate separately the individual characteristic curves of turbine and condenser, Fig. 1.

Turbine Heat Rejection

Since the vacuum a condenser is capable of maintaining is a function of turbine load, while the latter is in turn a function of the vacuum, equilibrium is determined by the intersection of the separate characteristic curves for each. From equations (1), (2) and (5) the condenser characteristic can be calculated and a curve plotted for a series of assumed values of heat rejection with a given circulating-water temperature.

Equation (1) determines outlet-circulating-water temperature, equation (2) the mean temperature difference and equation (5) the saturation temperature of steam entering the condenser. The resulting plot of vacuum against heat rejection for two inlet-water temperatures is indicated by curves *A* in Fig. 1.

Corresponding turbine-characteristic curves *B* are readily calculated for any generator output. The net heat removed in the circulating water can be found from equations (8) and (9).

The intersection of these two curves determines actual vacuum to be obtained with turbine and condenser operating in equilibrium. Intersection with the turbine curve corresponding to maximum steam flow, the limiting case, indicates maximum load that can be obtained from the generator for any circulating-water temperature.

Selection of proper size of a new condenser is somewhat more difficult than calculating the performance of an existing unit. Surface area, tube size, tube length and water flow are unknown quantities. These additional variables greatly increase the amount of computation. It is desirable to establish certain practical rules that fix, temporarily at least, some of the variables so that the remainder may be more rapidly evaluated.

Suggestions for selection of tube size, tube length and water velocity do not necessarily mean that these should be determined at the outset, but rather that tentative values should be selected based on physical conditions surrounding the installation. Then these values may be employed or others assumed in making such economic checks as the magnitude of the installation warrants.

By use of charts, surface area, water flow and resulting vacuum for any set of conditions can be determined rapidly. With very little labor a number of hypothetical condensers can be set up and then subjected to economic analysis to determine what combination of surface, water flow and vacuum is optimum.

Physical limitations in the plant help establish tube length. In general, the longer the tube the less expensive is a given size condenser. However, the practical limit of tube length is soon reached because of increased building cost in providing room for tube withdrawal. Also there is the practical difficulty in obtaining satisfactory longitudinal steam distribution within the condenser shell. This latter effect is particularly apparent in small units having an exhaust-steam inlet with a diameter small compared to the length of shell. Steam entering at right angles to the tubes has difficulty in distributing itself longitudinally, tending to confine condensing action to the central portion of the condenser.

Condenser tubes are normally supplied in ¾-in., ⅞-in. and 1-in. sizes but the majority of new installations are ¾-in. The larger sizes more easily pass water containing debris and thus have less tendency to plug at their inlets. Tube plugging, however, can be largely overcome by properly sized mesh of traveling intake-water screens in which the openings are, say, one half the tube diameter.

Reference to Fig. 2 shows that ¾-in. tubes have higher heat-transfer rate at any given water velocity than larger

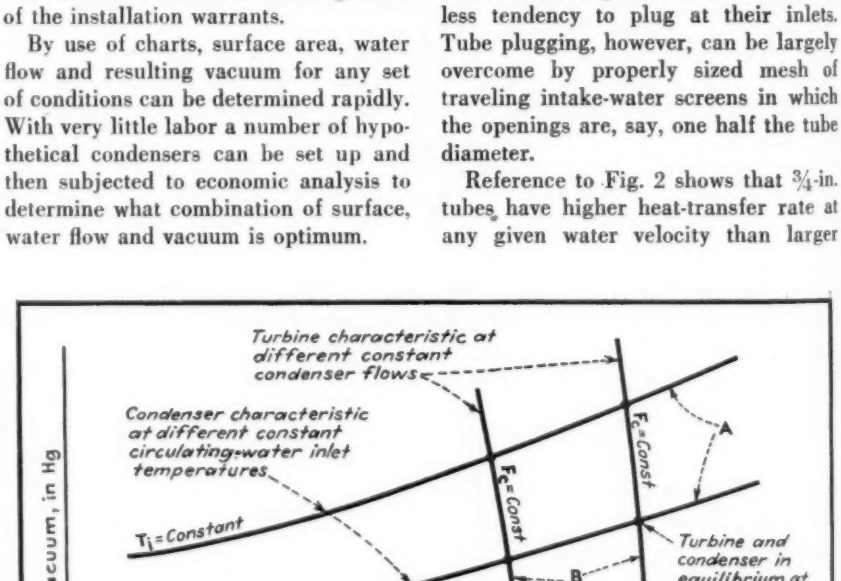


Fig. 1—Equilibrium conditions between turbine and condenser are indicated by intersection of characteristic curves for the condenser, *A*, and the turbine, *B*

Calculations

By W C WOODMAN
Stone & Webster Engineering Corp

CONDENSER CHARACTERISTIC EQUATIONS

Two fundamental equations of heat transfer are:

1. $Q = F' (t_o - t_i) = 500\ F\ (t_o - t_i)$
2. $Q = U\ \theta_m\ S$

and by definition

3. $k = \frac{F}{S}$

Combining (1), (2) and (3)

4. $500\ F\ (t_o - t_i) = U\ \theta_m \frac{F}{k}$

By definition, mean temperature difference is:

5. $\theta_m = \frac{\theta_1 - \theta_2}{\log_e \frac{\theta_1}{\theta_2}} = \frac{t_o - t_i}{\log_e \frac{t_s - t_i}{t_s - t_o}}$

Combining (4) and (5)

6. $\frac{t_s - t_i}{t_s - t_o} = \log_e^{-1} \left(\frac{U}{500k} \right)$

Eliminating t_o by combining (1) and (6)

7. $Q = 500\ F\ (t_s - t_i) \left[1 - \frac{1}{\log_e^{-1} \left(\frac{U}{500k} \right)} \right]$

(Equation (7) contains five variables, if U/k is considered a single term. Those familiar with the construction of nomographic charts will recognize that this involves the use of one linear and two binary scales, as employed in Fig. 4.)

TURBINE CHARACTERISTIC EQUATIONS

8. $Q = F_s\ (H_{exh} - q)$

where H_{exh} is the total energy of the steam, Btu per lb, after expansion in the turbine and on exhaustion to the condenser

and q = heat of liquid at condenser pressure, Btu per lb (with zero hotwell depression) while H_{exh} is obtained from:

9. $H_{exh} = H_1 - \frac{3413\ W}{F_s \times \eta_m \times \eta_e}$

where H_1 = total energy of steam at turbine, or section, inlet, Btu per lb

NOTATION

Q = Net heat rejected to condenser, Btu per hr
F' = Circulating water flow, lb per hr
F = Circulating water flow, gpm = $F' \div 500$
F_s = Flow of steam to condenser, lb per hr
t_i = Inlet circulating water temperature, F
t_o = Outlet circulating water temperature, F
t_s = Saturation temperature of exhaust steam at vacuum prevailing in condenser, F
S = Condenser surface, sq ft
U = Over-all heat-transfer rate, Btu per sq ft per hr per deg F
θ_m = Logarithmic mean temperature difference
k = F/S
H = Total energy of steam, Btu per lb
q = Heat of liquid, Btu per lb
W = Electrical output of generator, kw
$\eta_m\ \eta_e$ = Combined mechanical and electrical efficiency

sizes. This fact is supported by theoretical considerations which demonstrate that heat-transfer film coefficients, both for liquid within the tube and vapor condensing on the outside surface, are inversely proportional to functions of the diameter.

However, the 5/8-in. tube characteristic is out of natural order. This size is customarily used only in small units which, because of rapid fouling or lack of maintenance, exhibit relatively low over-all heat-transfer rates in service. For this reason the performance of 5/8-in. tubes has been artificially depreciated.

Tube-wall thicknesses of No. 16 and 18 BWG are customary. The latter size is used almost exclusively in modern installations. While a somewhat longer life can be expected from the heavier tube wall of the former where the circulating water is particularly corrosive, it is generally better in such instances to employ an alloy having superior corrosion characteristics.

Water quality usually determines proper velocity. Reference to Fig. 2 demonstrates that increase in velocity improves heat-transfer rate. The increase, however, is subject to the law of diminishing returns and at high velocities the gain in heat transfer is small. Excessively high velocity is not conducive to reasonable tube life as both corrosion and erosion are accelerated. From the standpoint of reasonable tube life, velocities with brackish, silty or corrosive waters should not exceed 7 ft per sec, but higher velocities can often be economically justified for fresh water free of corrosive or erosive substances that hasten tube failure.

Availability of cooling water determines the number of passes. If large quantities are readily available with low operating and investment costs for pumping, a single-pass condenser is the more economical. If cooling water is relatively scarce or must be pumped a considerable distance, requiring high investment cost, more surface will be justified and a two-pass condenser will prove lower in over-all cost.

Inlet-Water Temperature

Temperature of inlet cooling water directly affects vacuum and unless recirculated water is used the designer has no control over this factor, which depends on season, climate, stream flow and other local conditions. Temperature may vary from 32 to 95 F or more with an annual average of perhaps 50 to 70 F.

Cooling-water temperature variation imposes two problems on the designer (1) determination of maximum capacity of the turbine-generator at decreased vacuum in summer and (2) selection of a true average temperature for evaluation of economic size.

(*Continued on page* 74)

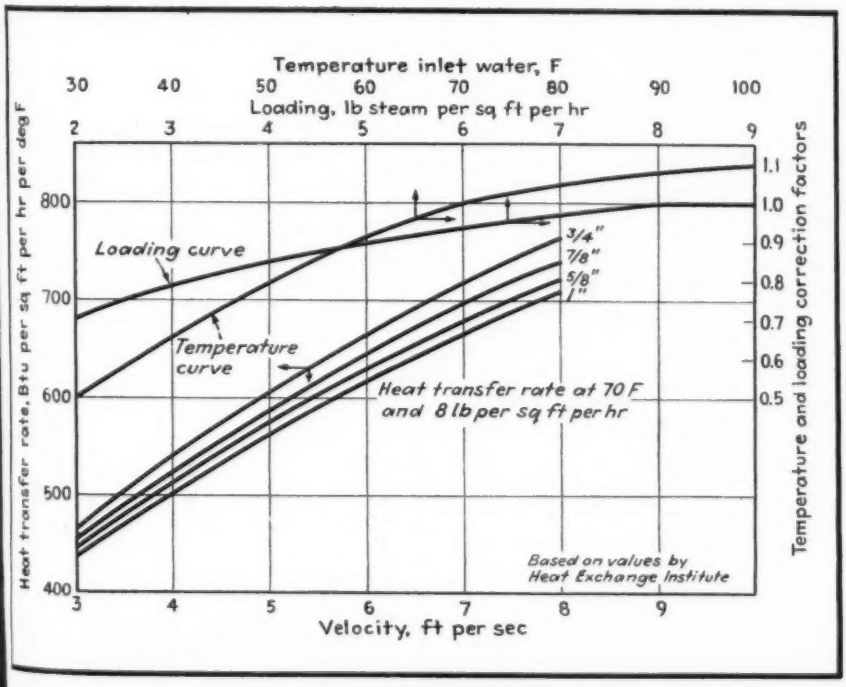


Fig. 2—Heat-transfer for each tube size, obtained from the lower group of curves, is corrected for steam loading and inlet-water temperature by use of the upper plot

Values of over-all heat-transfer rate in Fig. 2 are those employed by an association of condenser manufacturers known as the Heat Exchange Institute. Although they may be exceeded in specific instances, these are stated to be safe, conservative design values representative of new clean tubes in place. In actual service, scale, bacterial slimes and other marine growths collect on the inner tube-wall surfaces and decrease the effective rate of heat transfer. Thus a condenser ordinarily has an over-all heat-transfer rate less than that for clean tubes and the ratio of the two is termed *cleanliness ratio.*

A condenser using brackish harbor water contaminated by industrial wastes may have a cleanliness ratio of 0.70 or lower. For fairly clean river or lake water, the ratio may average 0.80 to 0.85. For water recirculated in a cooling tower and kept free of algae and slime by chlorination, the average ratio may exceed 0.90.

These foregoing practical considerations enable one to establish some approximate values for tube size, water velocity and cleanliness. These need not be final, but if tentative values are established, corresponding condenser surface, water flow and vacuum can be determined quickly for a whole series of condensers.

It is not always appreciated that selection of water velocity, tube size and number of passes definitely fixes ratio of water quantity to surface area. Determining velocity in a given tube establishes rate of flow, while fixing tube size, length and number of passes determines surface area. This being true for a single tube, it is also true for any number of parallel tubes so that irrespective of size of condenser a fixed ratio of flow to surface is maintained. This relationship appears in Fig. 3.

Fig. 4 is a graphical solution of equation (7). It may be used to find any one of the quantities involved. It is particularly useful, however, in determining the performance of a hypothetical series of condensers for which tube size and water velocity have been tentatively selected.

How to Use Chart

In all condenser work the inlet temperature of circulating water is an independent variable. This temperature, the water velocity, size of tube and cleanliness ratio, all known or assumed quantities which remain constant for any given argument, determine the over-all heat-transfer coefficient, U, from Fig. 2. Ratio of flow to surface, k, is found from Fig. 3.

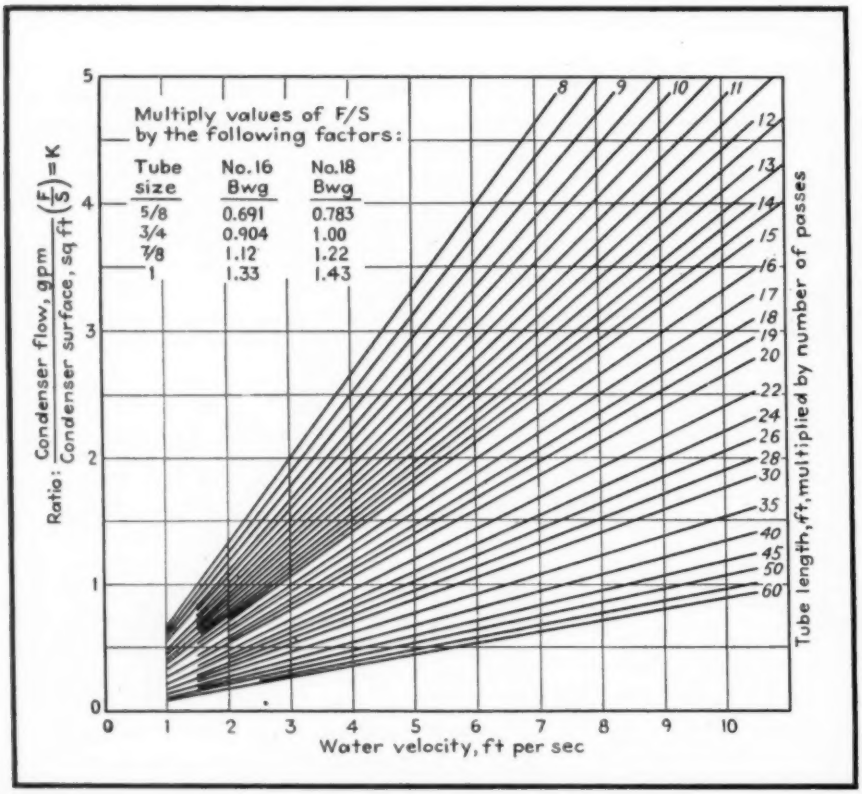


Fig. 3—Convenient ratio of gallons per minute per sq ft of condenser surface can be quickly determined from this chart drawn for ¾-in. No. 18 gage tubes

Fig. 4 is then entered with the ratio U/k for a given or assumed heat rejection, the quantity of water required to maintain a given exhaust-steam temperature (or vacuum) is determined or vice versa. Establishing water flow permits surface to be determined since k is known. Still using the same value of U/k, the process can be repeated and a series of values of flow and surface determined, that is, a series of condensers of different sizes is established together with the vacuum produced by each. The process may be repeated, if necessary, with other values of heat rejection corresponding to other loads on the turbine.

If the selection of proper size of condenser is to be on an economic basis, cost of different size units with their auxiliaries, plus costs of pumping and any other variable investment or operating costs, have to be compared with the value of additional generator output from the improved vacuum obtained with increase in condenser size.

An illustration from actual practice involved selection of a new turbine and condenser for an existing plant. Load conditions required that the machine develop not less than 7200 kw with 73-F circulating water. Steam conditions were 600 psig and 750 F. The turbine had a nominal rating of 7500 kw but at maximum throttle flow of 76,100 lb per hr could develop:

8050 kw at 29-in. vacuum
7500 kw at 28-in. vacuum
6950 kw at 27-in. vacuum
6620 kw at 26-in. vacuum

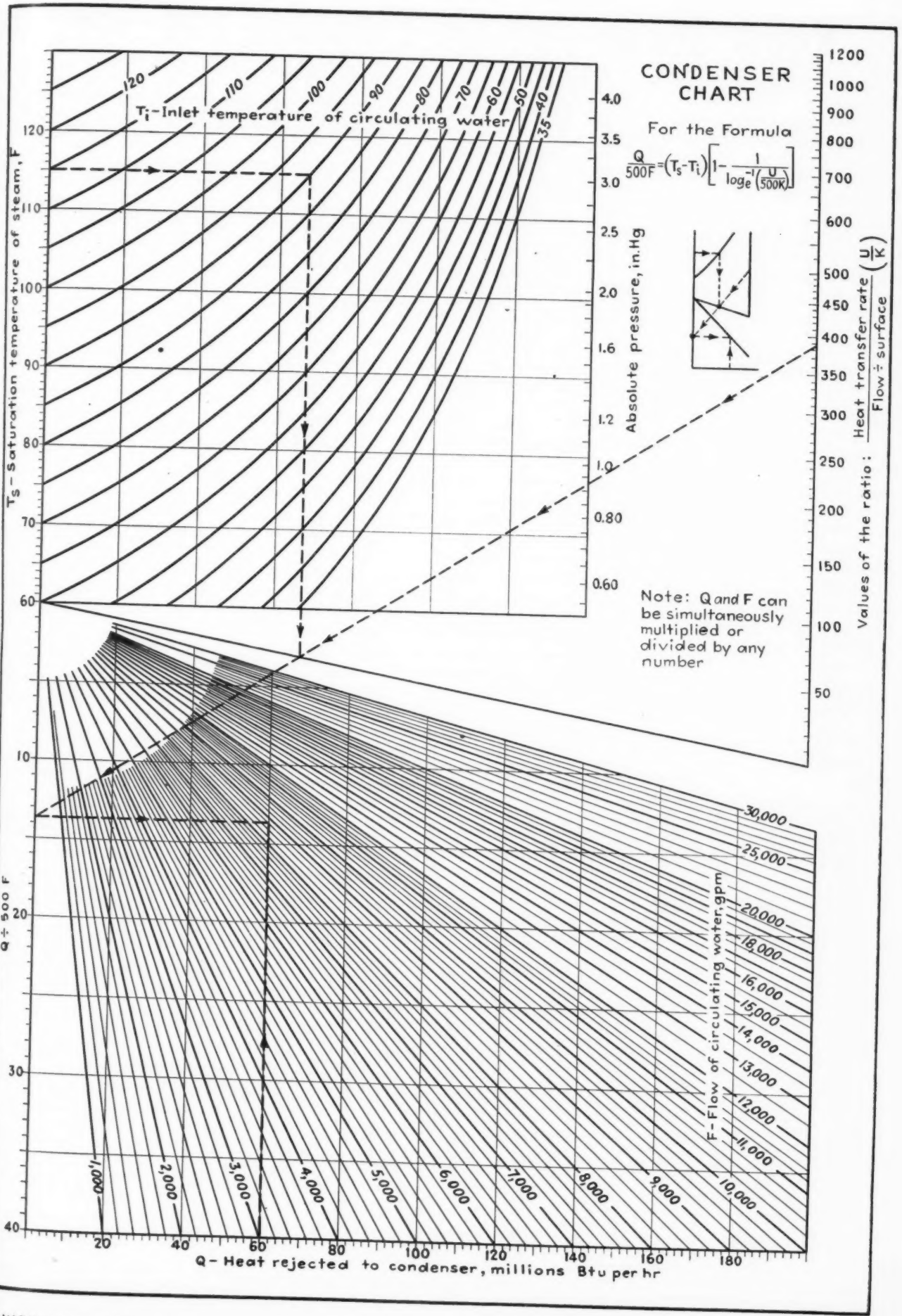
and the combined mechanical and electrical efficiency of the unit was 96%.

Circulating water from a river was fresh, free of silt and relatively uncontaminated with industrial waste. Existing condensers have ¾-in. No. 18 BWG tubes 12-ft long. If the new condenser were bought with tubes longer than 12 ft, worn tubes from it with inlet ends cut off could be reused in the older units, however, station layout limited tube length to 15 ft.

Because of the reuse factor, tubes had to be ¾-in. size but this is satisfactory

(*Continued on page* 150)

Fig. 4—Example: Inlet water temperature, 90 F; heat rejection, 60 million Btu per hr; tubes, ¾-in. No. 18 BWG, 12-ft long, 2 passes; allowable water velocity, 7.5 ft per sec; cleanliness factor, 80%; desired, 27-in. Hg vacuum. Solution: From Fig. 2, heat-transfer rate, 638; gpm per sq ft from Fig 3, 1.65; ratio 638 ÷ 1.65 = 387; from chart, flow is 8750 gpm; condenser surface is 8750 ÷ 1.65 = 5300 sq ft


CONDENSER CHART
For the Formula
$\frac{Q}{500F}=(T_s-T_i)\left[1-\frac{1}{\log_e^{-1}\left(\frac{U}{500K}\right)}\right]$
T_i – Inlet temperature of circulating water
120
110
100
90
80
70
60
50
40
35
T_s – Saturation temperature of steam, F
Absolute pressure, in. Hg
4.0
3.5
3.0
2.5
2.0
1.6
1.2
1.0
0.80
0.60
Values of the ratio: $\frac{\text{Heat transfer rate}}{\text{Flow} \div \text{surface}}\left(\frac{U}{K}\right)$
1200
1000
900
800
700
600
500
450
400
350
300
250
200
150
100
50
Note: Q and F can be simultaneously multiplied or divided by any number
Q ÷ 500 F
10
20
30
40
F – Flow of circulating water, gpm
30,000
25,000
20,000
18,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
20
40
60
80
100
120
140
160
180
Q – Heat rejected to condenser, millions Btu per hr

Know Steam-Jet Air Ejectors and They'll

BY PHILIP FRENEAU,
Worthington Pump & Machinery Corp

► STEAM-JET EJECTORS have almost entirely replaced wet and dry vacuum pumps and hurling jets as evacuating devices for removing air and vapors from condensers. Because of their obvious advantages over other air-removal equipment, ejectors need no sales talk. On the other hand, a discussion of ejector behavior enables this device to be used as an indicator of trouble within the entire condensing system.

Most users judge an ejector solely on the basis of main-condenser vacuum. Seldom is any great effort made to find out if air-removal apparatus is doing all it is capable of or if low vacuum reflects more than local trouble. Basically, an ejector is an extremely simple assembly of seven stationary parts accurately machined and aligned, Fig. 1. Minor differences in design such as external strainer, lack of nozzle extension or addition of nozzle plate between body and nozzle head have no significance in analysis of performance.

Despite its simplicity, an ejector's tapered passages and nozzles are machined to close tolerances and relative position of parts is of great importance to performance. For example, accidental omission or substitution of a gasket between nozzle head and body can seriously affect ejector operation.

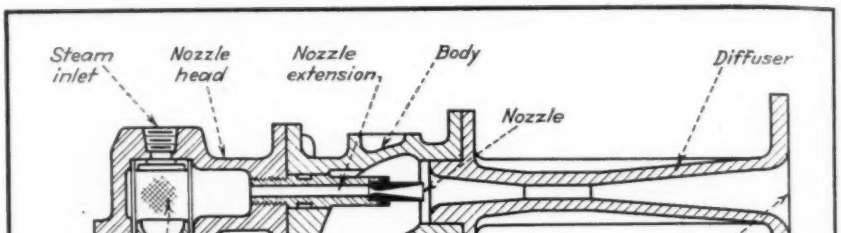


Fig. 1—Seven principal accurately machined and aligned parts make up a typical steam-jet air ejector. Jet path must be maintained for satisfactory service

High-pressure motive steam enters the nozzle through a strainer, expands, and leaves at high velocity. Vapor mixture entering the body is entrained by the high-velocity stream and the combination enters the diffuser section where velocity head is reconverted to pressure higher than that of the suction, but of course materially less than that of the motive steam.

Fig. 2 shows a typical ejector-performance curve at constant steam pressure. In percent of design conditions, capacity is related to suction pressure at left, and to discharge pressure at right. The capacity curve will be produced as long as system pressure at discharge is less than maximum safe pressure for a given suction pressure. This relation enables an ejector to act as a metering device to determine weight of mixture entering suction.

Of course exact slopes of curves for a specific ejector type are a function of its physical design as well as relative pressure conditions. In all ejectors, however, if system backpressure exceeds maximum safe discharge pressure for a given load, the unit operates "in the break" and capacity is no longer a function of suction pressure. Break operation is characterized by bobble or fluctuation in suction pressure. Some ejectors designed for modern vacuum do not show bobble in the break, but if discharge pressure is reduced or steam pressure increased, a lower suction pres-

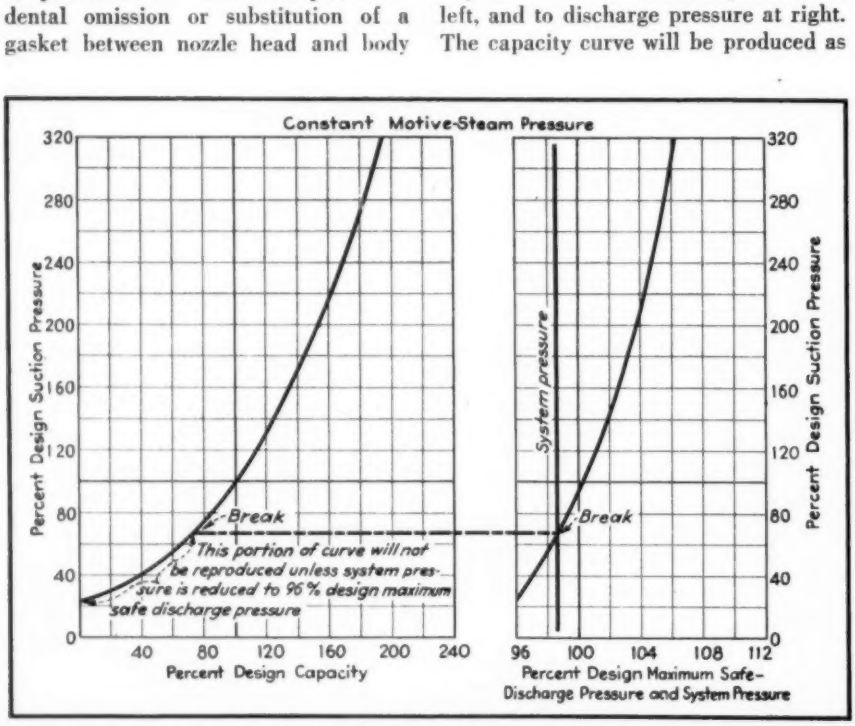


Fig. 2—Typical ejector performance curve with constant motive-steam pressure showing stable range and break point for percent suction and discharge pressure

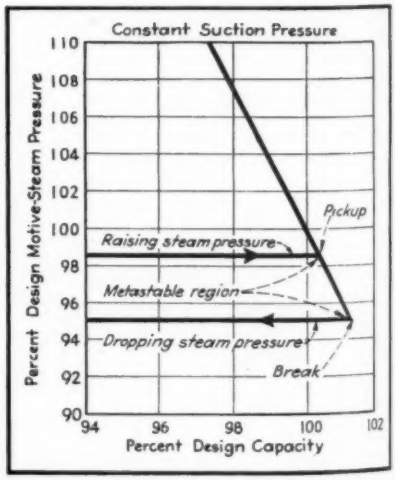


Fig. 3—Operation with steam pressure above design value actually decreases capacity; lower than design pressure causes approach to unstable operation

Serve You Well

Basic fundamentals of air removal equipment and how ejectors can forecast trouble within the apparatus they evacuate

sure results, indicating that the unit is operating unstably.

The discharge-pressure curve at right in Fig. 2 slants upward to the right indicating that operation against higher system backpressures is possible at high capacities than at shutoff. This slope is typical of a well designed ejector. Shifting position of the parts to stretch more capacity from a given assembly tends to make this curve more nearly vertical, undesirable and unsatisfactory if the characteristic bends back to cross the system-pressure line. This results in a point of instability as the ejector "pumps down" the system which may be serious enough to prevent establishing vacuum.

Chart at right of Fig. 2 also indicates why many ejector units are noisy or "rough" at or near shutoff. System pressure exceeds safe discharge pressure at very low load. As load increases, operation becomes stable.

Increased steam pressure increases maximum discharge pressure against which an ejector works stably. Fig. 3 shows the effect of steam pressure on capacity for constant suction and system backpressure. Increased steam pressure reduces capacity somewhat. Reducing steam pressure below design value increases capacity until the break is reached, at which point the curve falls off almost horizontally. If steam pressure is brought back slightly above break value, flow is not immediately reestablished; only when pressure exceeds that needed for pickup does full flow begin again.

Because of this characteristic, maximum discharge pressure curves are usually determined by pickup pressure rather than break pressure. Operation in the "metastable" region between pickup and break points should be avoided as momentary drop in steam pressure or rise in system backpressure may cause a break such that conditions do not reestablish themselves when the cause disappears.

Relative positions of break and pickup points can be varied by design of the ejector. They can be brought close together if desirable.

Normally an ejector should be operated as close to design pressure as possible, say 10 psi above rating to care for line fluctuations. Steam consumption varies directly with absolute steam pressure. A partly clogged steam nozzle tends to reduce steam flow and therefore has the same effect as decreased steam pressure.

Single-stage units alone or in parallel are suitable down to about 3-in. Hg suction pressure absolute. An aftercondenser is usually provided to recover heat and return condensate to the feed system. The after condenser has no effect on steam consumption of the ejector but does increase system backpressure slightly.

Where the ejector discharges against atmospheric pressure plus the resistance of exhaust pipe and possibly aftercooler, system backpressure is quite constant. Where an ejector exhausts into a feedheater, resulting system backpressure may vary considerably and the unit must be designed for the maximum expected system backpressure. In the latter case, unless steam pressure is throttled during periods of reduced backpressure, some efficiency as well as capacity is sacrificed.

Fig. 4 shows the effect of discharging into an open heater where the pressure varies between 18 and 20 psia. To illustrate the case, three system backpressure lines are shown as well as three curves of maximum safe discharge pressure for 100, 90 and 80 percent motive-steam pressure. Only one capacity curve is shown since increase in capacity gained by the lower steam pressure

SOME EJECTOR DEFINITIONS

Suction condition—Physical and thermal state of entering air-vapor mixture between suction flange and point of entrainment.

Discharge condition — Physical and thermal state of mixture measured at discharge flange.

Motive-steam condition—Physical and thermal state of steam at entrance to nozzle.

Stability—An ejector is stable when neither increase in steam pressure nor decrease in discharge pressure can cause a decrease in suction pressure for a given suction vapor load.

Safe pressures — Maximum discharge pressure or minimum steam pressure for stable operation.

System pressure — Back pressure caused by external factors acting on the ejector discharge.

Break—Point at which ejector passes from stable to unstable operation.

Pickup—Point at which ejector passes from unstable to stable operation.

Fluctuation—Cyclic variation in pressure.

Bobble—Rapid variation in pressure.

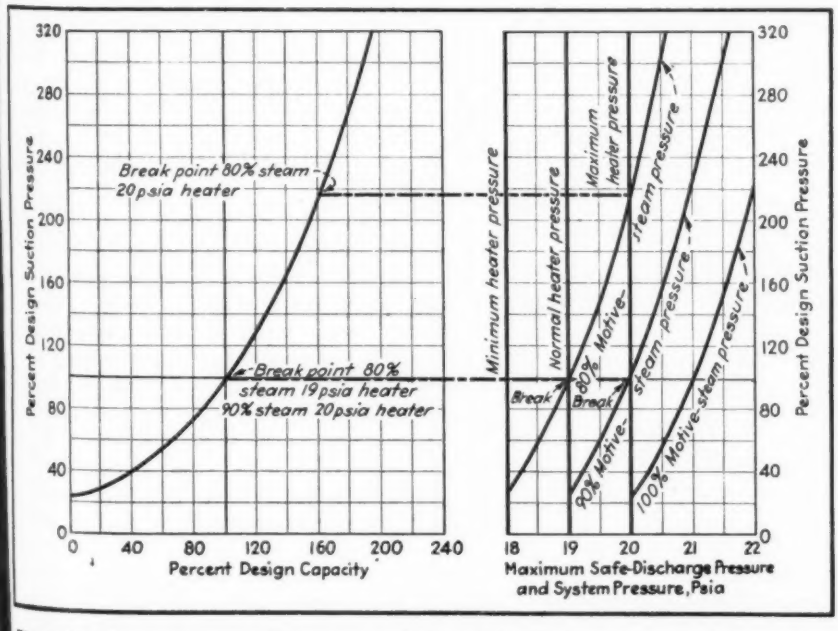


Fig. 4—Performance curve illustrates condition of the discharge to open heater where pressure varies from 18 to 20 psia with varying motive-steam pressure

is slight and can usually be neglected.

Since the maximum safe discharge pressure curve for 100% design steam pressure does not cross any of the system pressure lines, ejector operation with full pressure is stable throughout the entire range. With 90% steam pressure, however, the ejector is stable at design load and maximum heater pressure but unstable below design load unless heater pressure is reduced. Stable operation at shutoff can only be had if heater pressure is reduced to 19 psia. Reducing motive steam to 80% enables the unit to work with normal heater pressure of 19 psia at design load. However, 80% steam pressure is ample to permit stable operation throughout the full range if heater pressure is 18 psia.

While Fig. 4 is purely illustrative, it indicates the type of data obtained from test of specific ejector types and a form of plot that is extremely useful in determining proper application or cause of ejector failure. From these curves it is immediately evident whether or not steam pressure is sufficient for a given system pressure and if the ejector is producing the suction pressure it should at any load.

The more conventional single-stage application wherein system pressure is atmospheric plus vent and aftercondenser resistance is shown in Fig. 5. Such units are usually designed for a maximum safe discharge pressure about one half psi above normal. If steam pressure is abnormally low or barometer abnormally high, it is possible for the ejector to be unstable at low load. If operation near shutoff is necessary the ejector should be designed to work against maximum expected backpressure at shutoff.

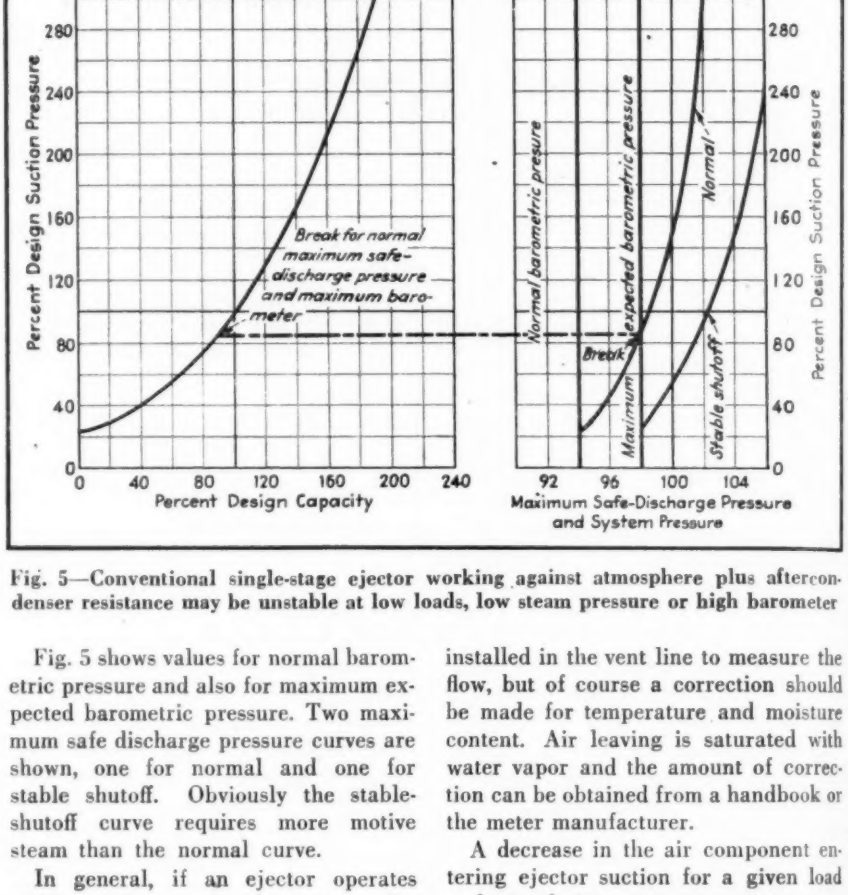


Fig. 5—Conventional single-stage ejector working against atmosphere plus aftercondenser resistance may be unstable at low loads, low steam pressure or high barometer

Fig. 5 shows values for normal barometric pressure and also for maximum expected barometric pressure. Two maximum safe discharge pressure curves are shown, one for normal and one for stable shutoff. Obviously the stable-shutoff curve requires more motive steam than the normal curve.

In general, if an ejector operates stably against a closed suction valve (no load) and produces the expected shutoff suction pressures, it can be expected to operate stably throughout its full load range. This check is easy to make and should be carried out at regular intervals.

The amount of air included can be readily measured if an aftercooler is provided. Any simple air meter can be installed in the vent line to measure the flow, but of course a correction should be made for temperature and moisture content. Air leaving is saturated with water vapor and the amount of correction can be obtained from a handbook or the meter manufacturer.

A decrease in the air component entering ejector suction for a given load and circulating water temperature accompanied by an increase in total weight of mixture may indicate trouble within the condenser itself. An increase in the metered air indicates increased leakage or increased non-condensables released from chemicals used for feedwater treatment.

Fig. 6 shows a schematic arrangement of condenser-ejector-aftercondenser system with instruments for the foregoing tests. Trap between aftercondenser and main condenser must work perfectly or false indications are obtained. To check trap, close gate valve for a few seconds. If vacuum improves, trap is probably stuck open. If trap is stuck closed water spouts out of the vent.

Normally only one ejector element is in service and the other isolated by a gate valve which must be absolutely tight to prevent air inleakage to the operating jet. Also, vent line and air meter should be large enough to assure backpressure within the limits of the ejector discharge characteristic. Loops and low points in both suction and discharge piping should be avoided or, if unavoidable, drained by traps.

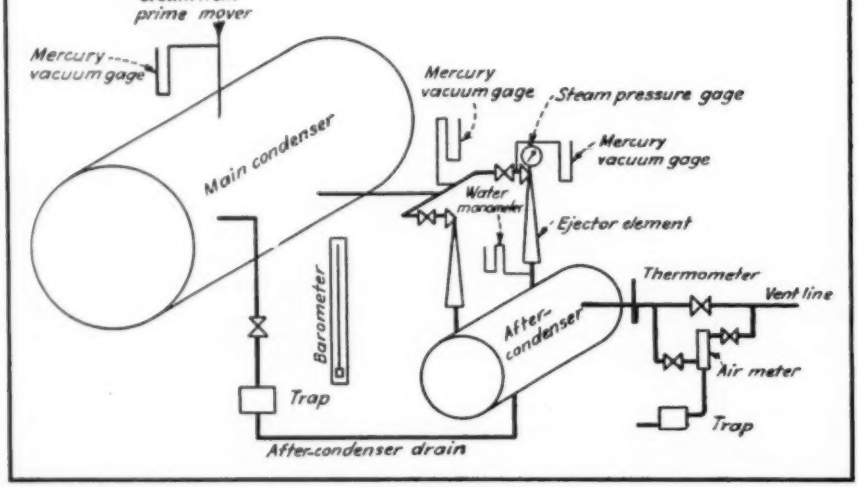
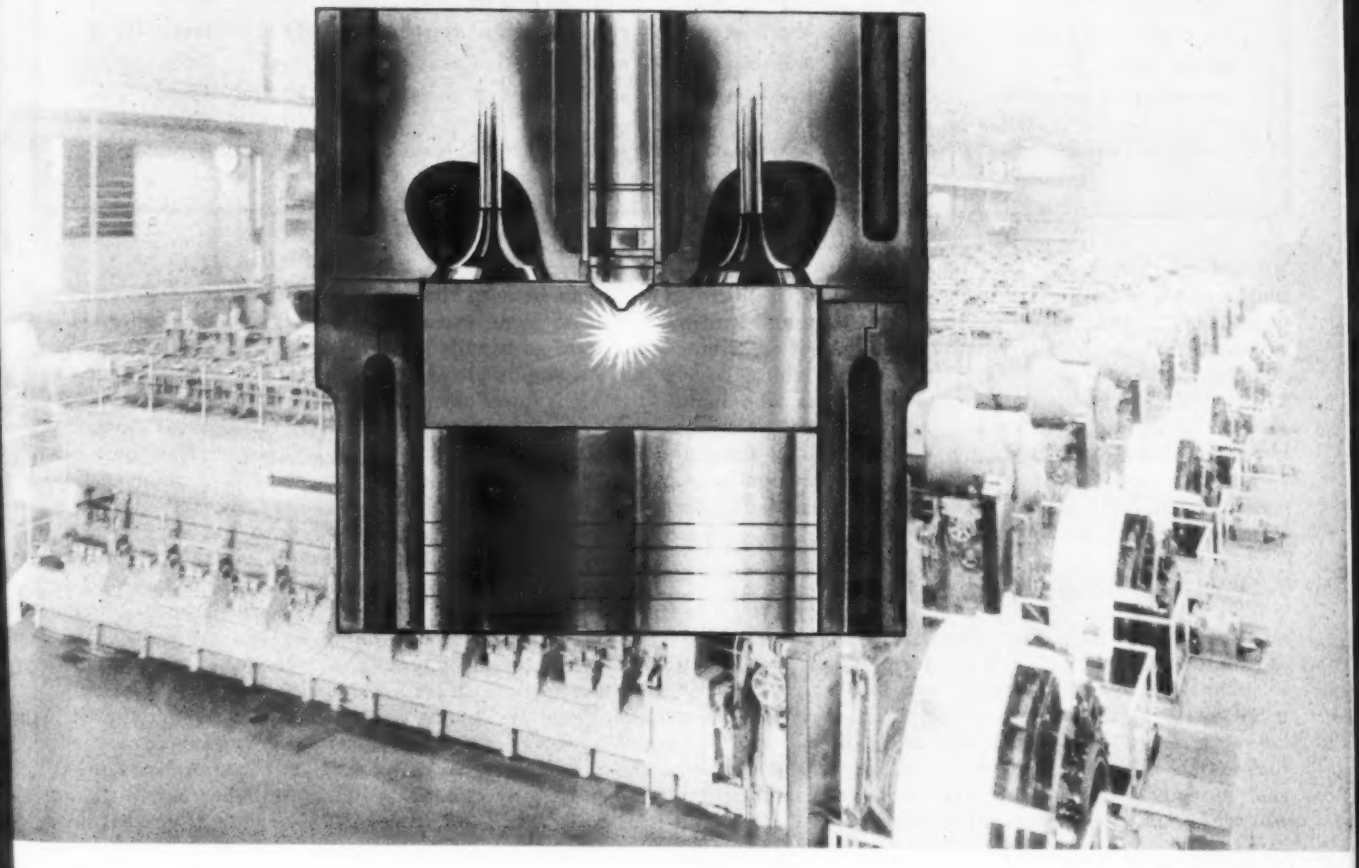


Fig. 6—Schematic arrangement of condenser-ejector system with the instruments, valves and traps necessary to check operation of condenser as well as ejector

Editor's Note: Another article dealing with multi-stage ejector installations by Mr. Freneau will appear in an early issue of POWER.

Diesel and Gas Engine FUELS and COMBUSTION



By L N ROWLEY, *Managing Editor*

Chemical combination with oxygen goes on around us all the time. Iron and other metals combine slowly with oxygen to form oxides, and this general process is called *oxidation*. *Combustion* is a special form of oxidation, in which the combination occurs rapidly with liberation of substantial amounts of heat.

Under some conditions, combustion may be self-starting. For example, coal piled outdoors combines slowly with oxygen, liberating heat. If the heat isn't dissipated, temperature rises, the reaction speeds up and eventually becomes rapid enough to be called burning.

Such *spontaneous* combustion is relatively uncommon. We are more familiar with combustion that begins with application of heat from some outside source. A fire laid in the grate, for example, will not light itself. Nor, for that matter, will a match. We start the combustion process by striking the match to generate friction heat enough to set it aflame. We use the match flame's heat to light the kindling, and the kindling's heat to start the logs. This process of using an easily ignited object to provide heat for the ignition of another is common in engineering.

We are all aware that some things burn more readily than others. In general, this depends on how easy it is to turn the particular substance into a gas, *because nothing burns unless or until it is a gas*. This, in turn, depends on the nature of the substance and on the amount of it compared with the amount of heat available to start the process. It's easier to start wood burning than coal and it's easier to ignite a small piece of wood than a large one.

The common candle illustrates the point well. To make the wax burn, we must turn it into a gas. With a wick, the heat from a match flame does the trick easily, without a wick it can't be done. Why? Without the wick, the limited heat available from the match is so small in comparison to the mass of wax that it can do no more than melt a small amount. None is vaporized, because there just isn't enough heat to do it. When a wick is added, the picture changes. The wick draws up, by capillarity, a very small amount of wax. The amount is so small in relation to the match flame that enough heat is available to raise the wax to the high temperature required for vaporization. Once it becomes a gas, burning is relatively easy to start

CLASSIFICATION OF INTERNAL-COMBUSTION ENGINES

Common designation	Usual fuel	Fuel introduced by	When and where fuel mixes with air	Comp ratio	Ignition method
Gas engine	Gas	Mixing valve	Outside, before compression	Low	Spark
Injection gas engine	Gas	L-p injection	In cylinder, during compression	Low	Spark
Gasoline engine	Vol liquid	Carburetor	Outside, before compression	Low	Spark
Injection gasoline engine	Vol liquid	H-p injection	In cylinder, before compression	Low	Spark
Hesselman engine	Fuel oil	H-p injection	In cylinder, end of compression	Low	Spark
Vaporizing oil engine	Fuel oil	H-p injection	In cylinder, end of compression	Low	Hot surface
Diesel engine	Fuel oil	H-p injection	In cylinder, end of compression	High	Compression
Gas-diesel engine	Gas	H-p injection	In cylinder, end of compression	High	Compression plus pilot oil
Gas-diesel engine	Gas	Induction	Outside, before compression	High	Pilot oil

and once the wax starts burning enough heat is liberated to continue the process of melting, vaporizing and igniting.

Although the wick is eventually consumed, it contributes nothing to the burning. It is purely a mechanical device to provide the conditions essential to starting and maintaining combustion. A similar problem faces every designer of boiler furnaces, firing equipment and internal-combustion engines, for while combustion is essentially a chemical reaction, most of the practical problems of fuel burning are mechanical.

COMBUSTION OF GASES

Perhaps most important among these problems is the job of turning a liquid or a solid into a gas, but for the moment, let's bypass this point and look at a few of the rules governing the combustion of gases. Assume that we have a gas, either produced from a liquid or a solid or a fuel that is normally gaseous. In burning this gas, or any gas, with air, it is first necessary to have a mixture that will ignite, and then to raise this mixture to the temperature of ignition. Let's look first at the matter of combustible mixtures.

From elementary combustion chemistry, we know that each of the fuel constituents of the gas requires a certain amount of oxygen for complete combustion. It thus becomes relatively easy to determine exactly how much oxygen is needed to burn a given amount of the gas and, since we supply the oxygen in the form of air, we can figure how much air will be required per cu ft of gas, or per lb. If we mix exactly this much air with the gas, we have a *perfect* or *theoretical* mixture. The relation between the gas and the air is called the *fuel-air ratio* and for any particular gas, the perfect ratio can be figured from a chemical analysis of the gas.

Now we have a combustible gas and the exact amount of air needed to burn it completely. We still need another element – heat. If such a perfect mixture is heated gradually, the rate of chemical combination increases until a point is reached where chemical combination no longer depends on heat from an outside source and practically instantaneous combustion occurs. The lowest temperature at which this will happen is called the *ignition temperature*. It may be defined as the temperature at which heat is generated by the combination faster than heat is lost to the surroundings and combustion thus becomes self-propelling. Below this point the gas-air mixture will not burn freely and continuously unless heat is supplied.

It can be seen that the actual ignition temperature depends to some extent on the surrounding conditions and the term as usually used refers to combustion in ordinary air. Among other factors, pressure affects ignition temperature; it is lower at high pressures.

These statements apply equally to mixtures that are not perfect, that is, to mixtures a little leaner or a little richer than perfect. But for each gas, there is a point where the mixture becomes too rich or too lean for ignition and continued burning. Almost everyone has experienced the difficulty of starting an automobile engine when a flooded carburetor produced an excessively rich mixture and most have seen the same engine "miss" when the carburetor is adjusted for too lean a mixture. Thus for each gas there is a range of mixtures which will ignite and continue to burn. These are called *inflammable mixtures*. The limits of this range are known as the *limits of inflammability*.

We now see that the essential steps in combustion of most fuels are: (1) turning the fuel into a vapor or gas if it isn't a gas to begin with, (2) bringing about a proper mixture of gas and air, and (3) providing the heat needed to ignite the gas-air mixture. Any number of means may be used to perform these steps but each must be accomplished. Providing proper conditions is the designer's job.

ESSENTIAL FUEL ELEMENTS

Methods used in any particular case depend to a large extent on the nature of the fuel involved. Hydrogen and carbon are the essential fuel elements. Sulphur and some other elements burn and give off heat but common practice considers the reactions negligible and the elements impurities. Hydrogen is a gas which can be liquefied only at extremely low temperatures; its boiling point at atmospheric pressure is -423 F. Carbon is a solid which cannot be completely vaporized at temperatures much under 6300 F. Heating value of both is high, 61,000 Btu per lb for hydrogen and 14,500 Btu for carbon.

Carbon and hydrogen exist in numerous combinations, called *hydrocarbons*. Most internal-combustion-engine fuels consist of these compounds. Characteristics of the different hydrocarbon series making up these fuels will be discussed later. At this point it is enough to know that they differ widely and thus different operating cycles and engine designs have been developed.

Internal-combustion engines differ in method of introducing fuel and mixing it with air, in compression ratio and in ignition method. From the combustion standpoint

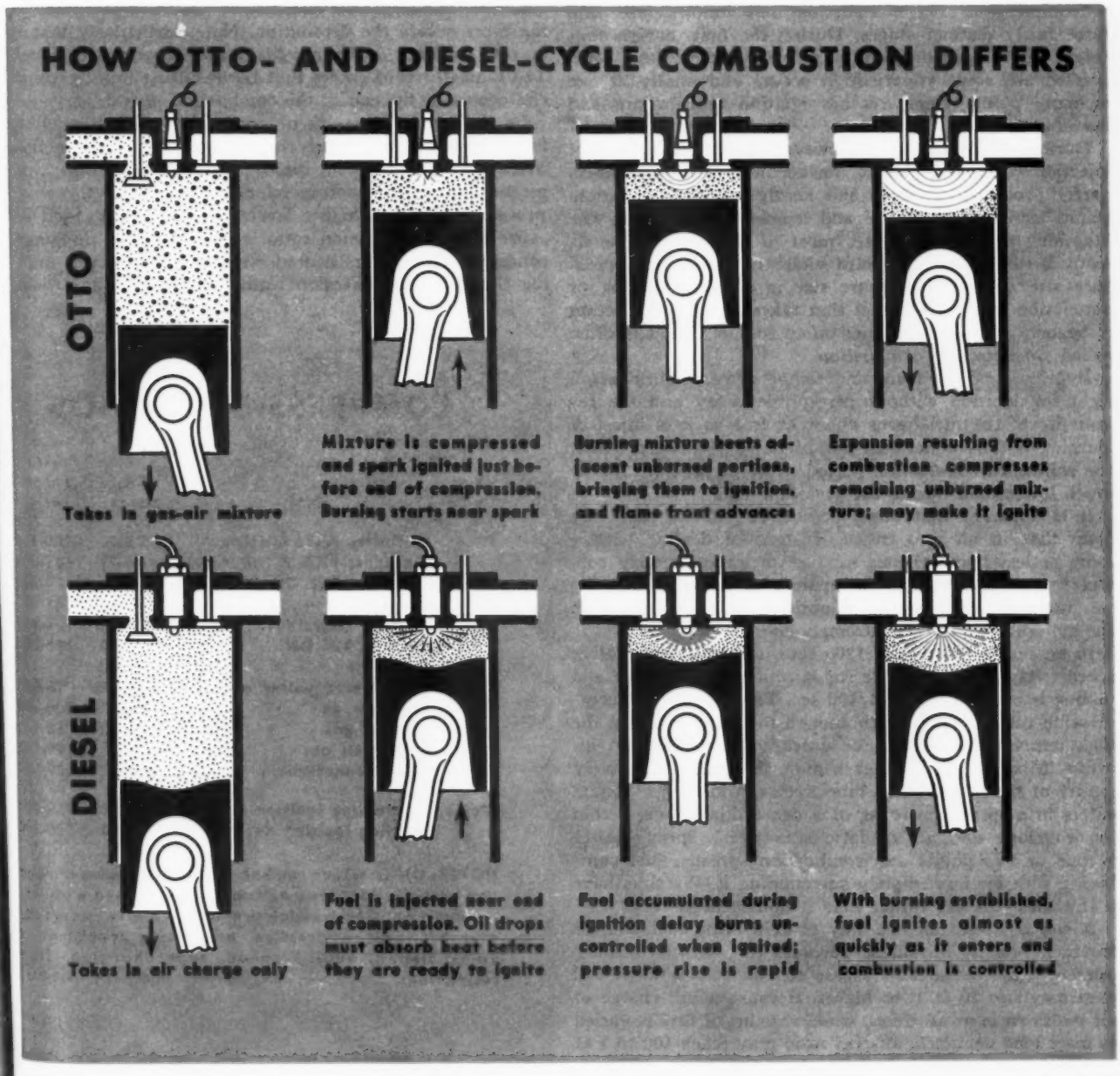
however, we can confine ourselves to two basic types, the spark-ignition *otto*-cycle engines burning gases and easily vaporized liquids, and the compression-ignition *diesel* engines burning relatively heavy liquids.

As a start, let's review the differences between these familiar operating cycles. In otto engines, fuel and air mix outside the cylinder, are compressed together and ignited by a spark just before the end of compression. The mixture burns rapidly at approximately constant volume, resulting in a rapid and large pressure increase. The resulting expansion drives the piston on its power stroke. Compression ratios range from about 4 to 1 to about 9 to 1, being limited by the nature of the fuel, as will be explained later.

In contrast, the diesel engine compresses air only, raising its pressure to more than 400 psi and its temperature to somewhere in the neighborhood of 1000 F. Into this heated air, fuel is injected in a finely atomized spray. Oil particles ignite and burn somewhat more slowly than the gas-air mixture of the otto engine, volume increases slightly during the combustion and the resulting pressure rise is slower and less in magnitude. Compression ratios range from about 12 to 1 up to about 22 to 1 in high-speed units.

Referring to the diagrams, let's examine these combustion operations more closely, starting with the otto engine. On the intake stroke, fuel and air enter the cylinder in a more or less homogeneous mixture. Air-fuel ratio runs close to perfect, about 14.5 to 1 in the gasoline engine. Compressing the mixture lowers the ignition point and raises the temperature. If compression is carried too far, mixture ignition point is reached and burning begins before it is desired. Such *pre-ignition* may occur even if compression doesn't quite raise mixture temperature to the ignition point because there are always hot spots, such as the spark plug, which might start combustion.

With compression pressure held low enough to avoid pre-ignition, a high-tension electric spark starts combustion just before end of compression. This intensely hot but short-lived spark raises temperature of immediately surrounding mixture above the ignition point and local burning starts. As mixture near the plug burns it heats adjacent portions which also begin to burn when they reach their ignition point. Thus combustion progresses through the mixture with an advancing *flame front*.


HOW OTTO- AND DIESEL-CYCLE COMBUSTION DIFFERS
OTTO
Takes in gas-air mixture
Mixture is compressed and spark ignited just before end of compression. Burning starts near spark
Burning mixture heats adjacent unburned portions, bringing them to ignition, and flame front advances
Expansion resulting from combustion compresses remaining unburned mixture; may make it ignite
DIESEL
Takes in air charge only
Fuel is injected near end of compression. Oil drops must absorb heat before they are ready to ignite
Fuel accumulated during ignition delay burns uncontrolled when ignited; pressure rise is rapid
With burning established, fuel ignites almost as quickly as it enters and combustion is controlled

As the first portion of the mixture burns, pressure rises and the remaining unburned portions are compressed. If remaining unburned mixture is compressed enough to raise its temperature above the ignition point, it will burn instantaneously, causing a rapid pressure rise. Resulting pressure waves produce vibration and noise, known as "knocking" or, more scientifically, as *detonation*. This represents a power loss because part of the energy released by the burning mixture goes into vibratory motion rather than useful work on the piston.

To sum up otto-engine combustion: (1) a more or less homogeneous mixture is produced outside the cylinder, (2) burning is started by an ignition device, and (3) the flame spreads progressively through the mixture. It can then be seen that such engines require fuels that are either gaseous or can be vaporized readily and that the mixture must remain within limits of inflammability for combustion to continue after it is started by the short-lived and highly localized spark. Compression ratio is limited by the need to avoid pre-ignition and, even more important, detonation.

DIESEL COMBUSTION

In the diesel engine, fuel in a finely atomized state, to make vaporization easier, enters the cylinder near the end of compression. The combustion that follows falls into three fairly distinct stages. During the first, or *ignition-delay* period, oil droplets absorb heat from the compressed air, some vaporization occurs and finally at one or more points vapor reaches ignition temperature and burning starts.

During the delay period, however short it may be, fuel injection continues, causing an accumulation of droplets partly processed by heat and nearly ready for ignition. Rapid increase of pressure and temperature following the beginning of burning causes most of the fuel charge already in the cylinder to burn violently and a rapid pressure rise occurs. If pressure rise is severe, knocking or detonation results. The fuel that takes part in this action is beyond control of the fuel pump so this period is often called *uncontrolled combustion*.

By this time, pressure and temperature conditions are right for ignition without perceptible delay and the remainder of the fuel burns about as fast as it is injected. Burning is thus under fuel-pump control and we call this the *controlled-combustion* period. Rate of pressure rise is much lower than during the preceding stage.

It is apparent that diesel combustion differs markedly from that in an otto engine. Instead of dealing with a more or less homogeneous mixture of approximately correct proportions which is prepared outside the cylinder, we must accomplish both vaporizing and mixing *inside* the cylinder, and in an extremely short time.

In an engine running at 1200 rpm, a not unconservative speed today, time available for injection, vaporization and mixing is of the order of 1/100 sec. This means that compression ratio must be high enough to insure reaching the high temperature needed for quick vaporization and ignition. Mixing is perhaps even more difficult. By the very nature of the process, fuel must seek out air. Injected fuel enters in a spray consisting of a dense liquid core, a thin fog envelope and all gradations between. Spray ignites at one or two points and combustion spreads, fuel combining with air immediately surrounding it. We thus have a *stratified* mixture rather than a homogeneous one.

It can be seen that one way to help bring fuel and air together lies in providing surplus air. Diesels usually operate with considerable excess *air*; air-fuel ratio at full load may run 20 to 1, or higher. Because a full charge of air is drawn in at all times, while amount of fuel is varied to meet load demands, air-fuel ratio may reach 100 to 1 at very light loads or idling. These ratios, of course, apply to the mixture as a whole and are in the nature of averages. In the actual stratified mixture, air-fuel ratio varies from point to point, being rich at some and lean at others.

From these brief and necessarily simplified outlines of otto and diesel combustion processes, it is evident that "knock" or detonation is critical in both. However, almost every factor that causes knock in an otto engine helps to avoid it in a diesel and what is anti-knock in one is pro-knock in the other. Clear thinking on this point proves important to successful operation and to evaluation of fuels.

To study detonation more closely, consider the three otto-engine operating cycles shown in the diagram, each of which has a different compression ratio. In the first it is fairly low and the flame travels progressively, with relatively quiet burning. The second shows the other extreme. If compression is high enough it can be imagined that, even without a spark, combustion will take place at once, starting at practically the same moment at every point of the charge. In other words, we have self-ignition and explosive burning, or what might be termed 100% detonation.

The third case shows the condition usually approached in practice. The progressing flame compresses the unburned charge, bringing it to approximately the condition of the total charge in the second case. It then self-ignites and explodes. The larger the quantity of unburned gas involved, the more severe the detonation. Note particularly that in an otto engine *it is the last gas to burn that causes knock*. The indicator card shows that the resulting rapid pressure rise occurs at the end of the combustion period.

In the otto engine, then, compression resulting from flame pressure is greater than that from piston action. With any given fuel, higher *piston-compression ratio* means higher *flame-compression ratio*, because the whole process starts at a higher level. For this reason, and because flame-compression ratio is essentially an imaginary concept not readily measured, we speak in terms of limiting the piston-compression ratio even though it is flame

COMPRESSION RATIOS

Cycle	Fuel	CR range	Pressure range, psig
Otto	Gasoline, 72-78 ON (auto)	5.5-7	100-150
	Gasoline, 87 ON (aircraft)	6-7	125-200
	Gasoline, 100 ON (aircraft)	7-8	150-225
	Kerosene	3.5-5.5	45-95
	Fuel oil (injected)	5.5-6.5	125-150
	Alcohol, 100 ON	7-10	125-200
	Coal gas	4.5-6.5	75-120
	Carburetted water gas	4.5-5.5	75-100
	Producer gas	5.5-7.5	100-160
	Natural gas	4.5-7.5	80-160
	Coke-oven gas	5.5-7	100-140
	Blast-furnace-gas	6-9	120-190
Diesel	No starting ignition device	12-22	350-700
	Starting ignition device	7-10	200-300

NOTES: ON = octane number. The higher values of ratio and pressure for kerosene can be approached with water injection. Compression pressures vary considerably, even for same compression ratio, being dependent on valve timing, engine speed, supercharging, flow restrictions. *Data from Marks Mechanical Engineers Handbook*

compression that causes the trouble. *Critical compression ratio* may be defined as that ratio at which detonation just begins to occur at maximum load.

Although detonation may be avoided to some extent by engine design and adjustment, the basic answers lie in holding down compression ratios or in developing fuels with anti-knock characteristics. And since high compression ratios mean more power and efficiency, emphasis naturally falls on fuel development. Speaking very crudely, we need fuels that are reluctant to self-ignite. An appreciable time lag between attainment of self-ignition temperature and actual start of burning permits flame from the spark to advance through the unburned mixture before it can self-ignite.

ANTI-KNOCK FUELS

Early research found that this depended to a large extent on molecular structure; long, thin molecules knock very badly while short, compact ones of the same weight knock but little. Thus we can measure anti-knock properties by comparison with an excellent anti-knock compound, *iso-octane,* and a badly knocking compound, *heptane.* The *octane number* of a fuel is the percentage by volume of iso-octane in a mixture of iso-octane and heptane which matches the knock characteristics of the given fuel when compared by a specified procedure in a test engine having a variable compression ratio.

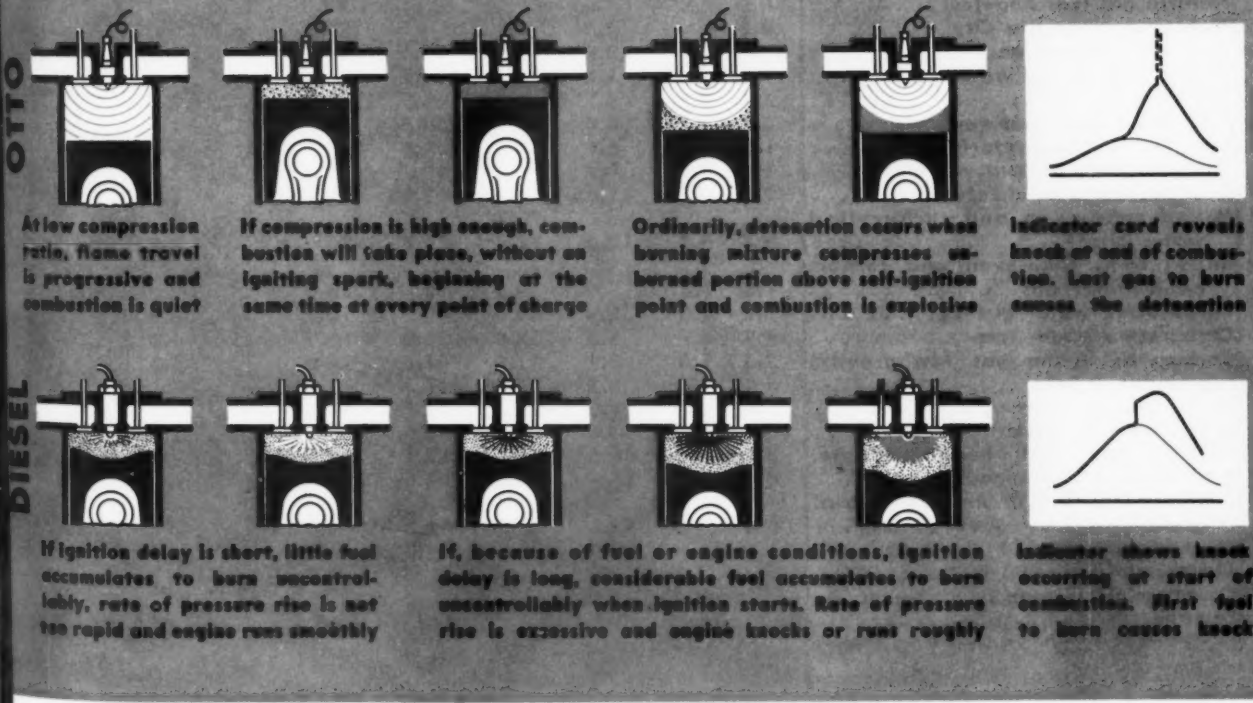
Discovery, in early knock studies, that addition of materials such as tetraethyl lead improved anti-knock characteristics led to widespread use and attention returned to the more difficult job of rearranging molecular structure only when demand came for super aviation fuels. These developments have now progressed sufficiently to permit producing fuel compounds far superior to iso-octane, long considered a standard of anti-knock excellence.

Returning to the diesel and its knock problems, refer to the diagrams and remember that the ignition-delay period is critical. If delay is short, because fuel characteristics and engine design are well adapted to bring about prompt ignition, then only a small amount of fuel is in the cylinder when combustion begins. With only a little fuel involved in the rapid uncontrolled burning of the second stage, rate of pressure rise is fairly moderate and the engine runs smoothly. If ignition delay is substantial, considerable fuel accumulates and when combustion begins there is rapid pressure rise and knock, or at least rough running. It is apparent that *in diesels it is the first fuel to burn that causes knock.*

For smooth running, then, ignition lag must be held to the shortest possible time. This means designing the engine to insure attaining conditions suitable for prompt ignition, selecting fuels known to have good ignition characteristics, or both. In general, high compression ratio, high intake-air temperature and high head temperature tend to shorten ignition lag. The higher air density resulting from supercharging promotes heat transfer from air to fuel and also shortens lag. However, it is not easy to provide these lag-shortening factors without, in many cases, introducing other disadvantages. Thus, in spite of the admitted importance of ability to handle fuels of widely varying characteristics, the tendency is toward more narrow fuel specifications, particularly in high-speed engines.

As in the case of otto engines, molecular structure of the fuel exerts a marked influence on ignition quality. After many efforts to correlate familiar qualities, such as specific gravity, viscosity and aniline point, with ignition quality, it has become common practice to measure ignition quality in a standard variable-compression-ratio engine by comparison with a reference fuel. This fuel is made up of *cetane,* which has excellent ignition characteristics, and *alpha methylnaphthalene,* which is difficult to ignite. Fuels are rated by *cetane number,* which is the percentage of cetane in the reference-fuel mixture showing the same ignition performance as the test fuel. High cetane number indicates good ignition quality.

CAUSES OF DETONATION IN OTTO AND DIESEL ENGINES


OTTO
At low compression ratio, flame travel is progressive and combustion is quiet
If compression is high enough, combustion will take place, without an igniting spark, beginning at the same time at every point of charge
Ordinarily, detonation occurs when burning mixture compresses unburned portion above self-ignition point and combustion is explosive
Indicator card reveals knock at end of combustion. Last gas to burn causes the detonation
DIESEL
If ignition delay is short, little fuel accumulates to burn uncontrollably, rate of pressure rise is not too rapid and engine runs smoothly
If, because of fuel or engine conditions, ignition delay is long, considerable fuel accumulates to burn uncontrollably when ignition starts. Rate of pressure rise is excessive and engine knocks or runs roughly
Indicator shows knock occurring at start of combustion. First fuel to burn causes knock

GAS-ENGINE FUELS

Gas-engine fuels may be divided into three broad classes: (1) natural gas, (2) manufactured gases, and (3) byproduct gases. These differ in properties and, even more importantly, in commercial availability.

The origin of *natural gas* is not known but it is frequently found associated with oil and the two fuels are believed to have a common source. Natural gas is produced in more than 30 states and widespread pipeline networks make it available in some part of nearly every state. At present, proved reserves total about 110 trillion cu ft, which represents about 30 year's supply at current rate of use. Reserves are increasing and it is predicted that future discoveries will prove at least as large as discoveries to date, about 200 trillion cu ft.

Many of the new natural-gas discoveries are condensate fields, which lend themselves to the growing practice of recycling, in which gas is returned to the field after processing for natural gasoline. Returned gas can be withdrawn later for fuel use. The deeper drilling that is expected to characterize postwar crude-oil operations will increase gas yields, the ratio of gas to oil varying with depth. On the consumption side, use of natural gas as a raw material for natural gasoline, isobutane and chemical products continues to grow and may eventually compete substantially with fuel use.

As shown in the table below, natural-gas composition varies with the source, but *methane* (CH_4) is always the major constituent. Most natural gas contains some *ethane* (C_2H_6) and a small amount of nitrogen. Heat value runs in the neighborhood of 1000 Btu per cu ft. Gas from some areas, often called "sour" gas, contains hydrogen sulphide and organic sulphur vapors. The term *reformed* gas usually refers to lean gas made from natural gas.

MANUFACTURED GASES

Manufactured gases result from a number of different processes. *Coal gas* and *coke-oven gas* are produced by carbonizing high-volatile bituminous coal in retorts which exclude air and are heated externally by producer gas. Usually a number of byproducts result. Cleaned of impurities, these gases are roughly one-half hydrogen and one-third methane, plus small amounts of carbon monoxide, carbon dioxide, nitrogen, oxygen and illuminants (C_2H_4 and C_6H_6). Heat value runs around 550 Btu per cu ft.

The term *water gas* generally refers to a mixture of carbon monoxide, hydrogen and nitrogen obtained by passing steam and air alternately through a bed of incandescent carbon. Heat value averages less than 300 Btu per cu ft. This gas may be enriched by *carburetting* with oil which is converted into a permanent gas and mixes with the water

COMPOSITION AND PROPERTIES OF TYPICAL

No.	Gas	Constituents of gas — percent by volume							Illuminants	
		CO_2	O_2	N_2	CO	H_2	CH_4	C_2H_6	C_2H_4	C_6H_6
1	Natural gas (Birmingham)	...	...	5.0	....	....	90.0	5.0	...	...
2	Natural gas (Pittsburgh)	...	...	0.8	....	....	83.4	15.8	...	...
3	Natural gas (So. California)	0.7	...	0.5	....	....	84.0	14.8	...	...
4	Natural gas (Los Angeles)	6.5	...	....	....	....	77.5	16.0	...	...
5	Natural gas (Kansas City)	0.8	...	8.4	....	....	84.1	6.7	...	...
6	Reformed natural gas	1.4	0.2	2.9	9.7	46.6	37.1	...	1.3	(C_3H_6 0.8)
7	Mixed natural and water gas	4.4	2.1	4.7	25.5	35.1	23.1	4.7	0.2	0.2
8	Coke-oven gas	2.2	0.8	8.1	6.3	46.5	32.1	...	3.5	0.5
9	Coal gas (continuous verticals)	3.0	0.2	4.4	10.9	54.5	24.2	...	1.5	1.3
10	Coal gas (inclined retorts)	1.7	0.8	8.1	7.3	49.5	29.2	...	0.4	3.0
11	Coal gas (intermittent verticals)	1.7	0.5	8.2	6.9	49.7	29.9	...	3.0	0.1
12	Coal gas (horizontal retorts)	2.4	0.75	11.35	7.35	47.95	27.15	...	1.32	1.73
13	Mixed coke-oven and carburetted water gas	3.4	0.3	12.0	17.4	36.8	24.9	...	3.7	1.5
14	Mixed coal, coke-oven and carburetted water gas	1.8	1.6	13.6	9.0	42.6	28.0	...	2.4	1.0
15	Carburetted water gas	3.0	0.5	2.9	34.0	40.5	10.2	...	6.1	2.8
16	Carburetted water gas	4.3	0.7	6.5	32.0	34.0	15.5	...	4.7	2.3
17	Carburetted water gas (low gravity)	2.8	1.0	5.1	21.0	47.5	15.0	...	5.2	2.4
18	Water gas (coke)	5.4	0.7	8.3	37.0	47.3	1.3	...	...	...
19	Water gas (bituminous)	5.5	0.9	27.6	28.2	32.5	4.6	...	0.4	0.3
20	Oil gas (Pacific Coast)	4.7	0.3	3.6	12.7	48.6	26.3	...	2.7	1.1
21	Producer gas (buckwheat anthracite)	8.0	0.1	50.0	23.2	17.7	1.0	...	...	...
22	Producer gas (bituminous)	4.5	0.6	50.9	27.0	14.0	3.0	...	...	...
23	Producer gas (0.6 lb steam per lb of coke)	6.4	...	52.8	27.1	13.3	0.4	...	...	...
24	Blast-furnace gas	11.5	...	60.0	27.5	1.0	....	...	...	...
25	Commercial butane	..	(C_4H_{10} 93.0)		....	(C_3H_8	7.0)	...	...	...
26	Commercial propane	...	(C_3H_8 100.0)		....	....	....	...	...	...
27	Sewage gas	34.8	Trace	2.8	....	Trace	62.4	(Trace of H_2S)		

All data except for sewage gas from American Gas Association

gas. This increases the heat value to about 550 Btu per cu ft.

Where cheap oil is available, *oil gas* may be made. Like coal gas, this runs about one-half hydrogen and one-third methane, with a heating value of approximately 550 Btu.

The manufactured gases described in preceding paragraphs are those commonly distributed. The gas served in a given area may be a mixture of two or more of them or a mixture of natural gas and a manufactured gas. The heat value is usually held to 525-550 Btu, often fixed by state or local ordinances.

Although it is a manufactured gas, the low heat value of *producer gas* (125-150 Btu per cu ft) makes it uneconomical to distribute it and thus it finds use close to the point of production. It is made by firing coal with a supply of air insufficient for complete combustion, either with or without admixture of steam. It runs about one-half nitrogen, one-quarter carbon monoxide and one-sixth hydrogen. Fuels other than coal may be used and in many parts of the world producer gas is made from waste materials.

Commercial *butane* and *propane* are essentially byproducts of the manufacture of natural gasoline and of certain refinery operations. As supplied, propane (C_3H_8) is essentially pure, while butane (C_4H_{10}) usually contains a small amount of propane. Both compounds have high heat values and are easily liquefied at low pressure. They are widely used as "bottled" fuels.

Blast-furnace gas, a byproduct of iron-making, has the lowest heat value of any commercial gas, about 90 Btu per cu ft. It is close to three-quarters nitrogen and carbon dioxide, the only important combustible constituent being carbon monoxide. Raw gas usually contains a high concentration of solid impurities and is normally washed before use.

In recent years, use of the gas produced by digesting sewage sludge has become common practice in disposal plants. In sewage plants employing chemical treatment, the gas so generated will fuel sufficient engine capacity to meet all power requirements while in aeration plants it will meet close to one-half of the greater power demands of this treatment process. *Sewage gas,* or *sewage-sludge gas,* runs about two-thirds methane and one-third carbon dioxide, with small quantities of hydrogen and nitrogen. Usually some hydrogen sulphide is present. Heat value is about 650 Btu.

COMMERCIAL GASES

Specific Gravity	Cu ft air per cu ft gas	Btu per cu ft, gross	Btu per cu ft, net	Net Btu per cu ft mixture	No.
0.60	9.41	1002	904	86.0	1
0.61	10.58	1129	1021	87.0	2
0.64	10.47	1116	1009	87.0	3
0.70	10.05	1073	971	86.7	4
0.63	9.13	974	879	86.0	5
0.41	5.22	599	536	89.6	6
0.61	4.43	525	477	91.7	7
0.44	4.99	574	514	87.0	8
0.42	4.53	532	477	90.7	9
0.47	5.23	599	540	89.9	10
0.41	4.64	540	482	89.0	11
0.47	4.68	542	486	89.0	12
0.58	4.71	545	495	90.0	13
0.50	4.52	528	475	89.3	14
0.63	4.60	550	508	96.2	15
0.67	4.51	534	493	94.2	16
0.54	4.61	549	501	94.3	17
0.57	2.10	287	262	96.6	18
0.70	2.01	261	239	87.2	19
0.47	4.73	551	496	90.5	20
0.86	1.06	143	133	70.5	21
0.86	1.23	163	153	74.6	22
0.88	1.00	135	128	70.3	23
1.02	0.68	92	92	59.5	24
1.95	30.47	3225	2977	90.5	25
1.52	23.82	2572	2371	91.2	26
0.92	6.0	640	575	82.1	27

HEAT-VALUE DIFFERENCES

Most commercial gases are fuel in the ultimate form, ready for combination with air, ignition and combustion. Thus the number of characteristics which the user must consider are few. Aside from chemical composition, and presence of dirt or other impurities, major interest centers in heat value. In this connection, it is important to understand clearly the distinction between *high* or *gross* heat value and *low* or *net* heat value.

The hydrogen in fuels combines with oxygen to form water and some of the heat released by combustion goes to evaporate and superheat this water. Unless the products of combustion are cooled down enough to condense the vapor back into water, this heat is lost. The *high* heat value is the *total* heat released by combustion of a given fuel while the *low* value is the total heat released *minus* the heat required to vaporize the water formed by combination of hydrogen and oxygen.

Whether it is proper to charge against an engine or other piece of fuel-burning equipment the heat lost in vaporizing the water formed has long been a matter for debate. It is standard practice to use high heat value in computing and expressing the performance of steam plants and diesels.

Gas engines, however, operate on a range of fuels containing anywhere from zero to about 30% hydrogen, by weight. This makes a difference of more than 10% between high and low heat values in the case of a gas rich in hydrogen. If high values were used it would prove difficult to rate or guarantee engines except for a specific fuel of known hydrogen content. However, if low values are used, heat rate or thermal efficiency differences from one fuel to another become negligible. For this reason, gas engines are rated, guaranteed and tested in terms of low heat value.

MIXTURE HEAT VALUE

From the chemical composition of a gas it is relatively simple to compute the amount of air required for a theoretically perfect mixture (see POWER, Feb 1944, pp 86-91). As a rough rule, figure slightly less than one cu ft of air for every 100 Btu of heat value. The table gives, for each gas, the high or gross heat value, the low or net value and the cu ft of air required for a perfect mixture.

Gas engines operate on a mixture that approaches the theoretical. Thus, from the gas-engine standpoint, the heating value of such a mixture is a most important consideration. Other things being equal, the lower the heat value of a given mixture, the lower will be the output from a cylinder of given dimensions. An engine operating on producer gas or blast-furnace gas, for example, must be derated considerably in comparison to output on, say, natural gas. It is worthy of note that gases showing high Btu content per cu ft do not always produce combustible mixtures of high heat value. Butane, with a heat value for the gas of 2977 Btu per cu ft, shows a mixture heat value of 90.5, which is exceeded by the mixture value of water gas (96.6) which has a net heat value for the gas itself of 262 Btu per cu ft. This results from differences in the chemical composition.

DIESEL-ENGINE FUELS

While early diesels often had to and could operate on nearly anything that would burn, petroleum was and still is the principal source of fuel. Modern low-speed units can successfully handle lower grades of petroleum products but engines of higher specific output tend to require a narrower range of fuels. In the future, both designers and operators will need to know more about fuel characteristics.

Although some crude oil is used directly, particularly in oil-field and pipeline operations, fuels commonly burned are refined products. Crude oils from which they are refined vary little in chemical compositon, consisting of 83-87% carbon, 10-14% hydrogen, and oxygen, nitrogen and sulphur in small amounts or traces. Hydrogen and carbon are combined as *hydrocarbons* and the form of combination differs considerably in crudes from different localities.

For convenience, chemists classify types of hydrocarbons by their molecular structure. Carbon and hydrogen atoms link up in more or less regular patterns to form *series*, which differ in the number of hydrogen atoms linked to a carbon atom. One such series, the *paraffins*, link up according to the formula C_nH_{2n+2}. The *n* merely indicates any given number of atoms and the formula means that if we have, for example, 4 carbon atoms, we will find 2x4+2, or 10, hydrogen atoms with them. Octane, C_8H_{18}, is a member of this family, which contains combinations as complex as $C_{60}H_{122}$. This series is called *saturated*, because it is impossible to add hydrogen without replacing one of the hydrogen atoms already in the molecule.

Hydrocarbon compounds differ also in the way the atoms are arranged, some being *chain* compounds and some *ring* compounds. For example, the two series, *olefins* and *naphthenes*, have the same general formula, C_nH_{2n}, but the olefins are unsaturated chain compounds and the naphthenes are saturated ring compounds. Other series are *diolefins*, C_nH_{2n-2}, unsaturated chain compounds, and *aromatics*, C_nH_{2n-6}, unsaturated ring compounds.

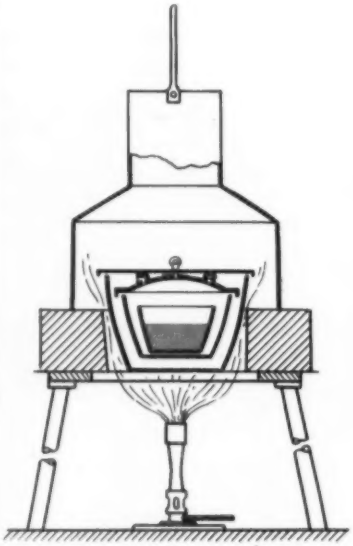
HYDROCARBON PROPERTIES

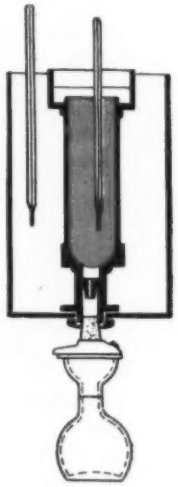
These series are worth knowing because they have different burning characteristics in engines. In general, the properties of members of any one series vary more or less uniformly with their position in the series. Although compounds of different series may show nearly the same carbon and hydrogen content, they may differ considerably in properties. As a general rule, the simpler compounds are gases or "light" liquids, and the "heavy" liquids consist mainly of complex hydrocarbons.

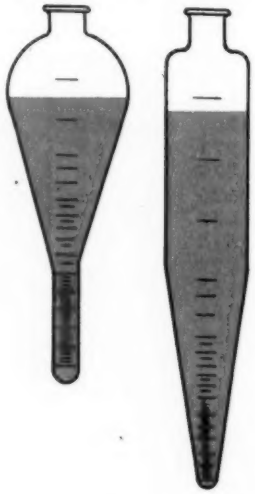
Most engineers have heard crudes referred to as "paraffin-base" or "asphalt-base". Such designations are not particularly accurate but it is interesting to know the type of hydrocarbons forming the main constituent. Thus the Pennsylvania crudes are rich in paraffins while the Mid-Continent crudes, often referred to as "mixed-base", are composed mainly of paraffins and naphthenes. California crudes are mainly olefins and aromatics.

Being a manufactured product, fuel oils show characteristics that depend, in the main, more on the refining pro-

PROCEDURES FOR MEASURING







CONRADSON CARBON

Indicates relative carbon-forming propensity. Oil is evaporated from porcelain crucible, containing two glass beads, inside covered iron crucible resting on sand in sheet-iron crucible. A circular hood and chimney rest on a refractory ring. After oil distills and vapor burns, residue is weighed and expressed in percent of sample

VISCOSITY

Saybolt Universal viscosimeter consists of tube with standard orifice, immersed in a bath to keep temperature constant. With oil at test temperature, time to reach receiving-flask level is measured and viscosity expressed in seconds. For heavy oil, *Saybolt Furol* unit is used and time is in seconds *Furol* instead of in seconds *Universal*

WATER, SEDIMENT

Combined amount of water, sediment may be measured in centrifuge using calibrated tubes. A bath holds desired temperature. Each of two tubes used contains 50 ml of 90% benzol and 50 ml of test oil. One tube goes on each side of centrifuge. Amount of water and sediment is read on graduations; sum of two is percent

WATER

Determination of water alone is made by mixing test oil with a solvent and distilling in metal or glass flask equipped with a glass condenser and glass trap. Distillation of 50 ml sample in 50 ml of solvent continues until no water is visible except in trap. Volume of water in trap, multiplied by 100 and divided by sample volume, is percent

cess than on the nature of the crude. In this connection, it should be remembered that most petroleum refining has as its object the production of gasoline and that changes in the processes have resulted largely from the desire to obtain higher yields of gasoline from a given quantity of crude oil.

Until World War 1, virtually all crude was refined by simple distillation, which takes out of the crude only what nature put into it. Amount and character of products depend largely on characteristics of the crude. Yield of gasoline is low; the intermediate *distillates* from Pennsylvania and Mid-Continent crudes make good diesel fuels. This method, however, now finds use mainly in small refineries or as the starting point of a more complex process.

Thermal cracking represented the first big step toward higher gasoline yields. High temperature breaks down the hydrocarbons forming the heavy fractions of a crude; some lighter and some heavier fractions result. Whether the crude is cracked directly, or after it has been "topped" of its gasoline, the result is more gasoline, less intermediate oil and more heavy oil. Thermally cracked oils are apt to be highly olefinic and are considered poor diesel fuels.

During the past few years, refining techniques have been greatly changed by the introduction of *catalytic cracking* and other processes such as polymerization, isomerization and alkylation. It is still early to evaluate these changes but a number of points seem reasonably clear: (1) maximum possible gasoline yield has been greatly increased, (2) the refiner has gained almost complete control over the relative yields of various products, and (3) the process has taken on the aspect of producing fuel constituents of specific characteristics and blending these to obtain the desired final result. This latter is true today for aviation gasoline; it may soon be true for fuel oils.

Catalytic cracking gives greater yields of higher antiknock gasoline and less of heavy residuals. Heavy fractions can be re-cracked to lighter. This means that oils normally destined for sale as diesel and furnace fuels can be made into gasoline. The refiner may be expected to decide which course to follow on the basis of comparative profit. Thus fuel oils seem to be out of the byproduct class for good, but what effect this may have on supply and price depends on relative demands for gasoline and fuel oil.

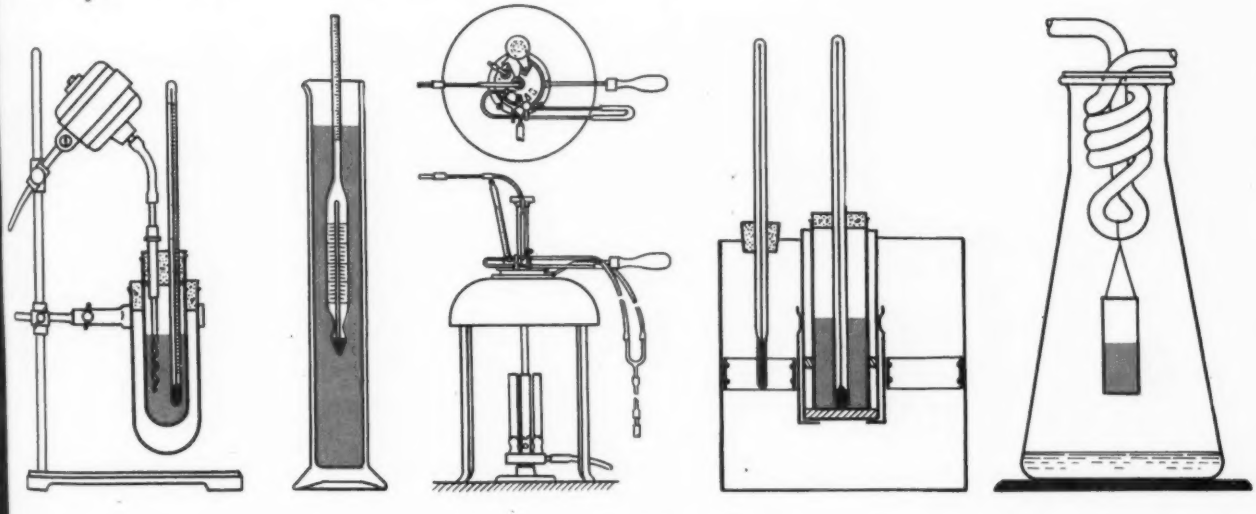
CATALYTICALLY CRACKED FUELS

There are some indications that catalytic cracking may benefit the diesel-fuel purchaser. Limited experience indicates that catalytically cracked oils show better diesel-fuel qualities than those resulting from thermal cracking, qualities not far from those of straight-run oils from the same crudes. Thus expected postwar expansion of catalytic cracking may well tend to make reasonably good diesel fuels available in greater quantity than when all cracking was of the thermal type.

To sum up: Present opinion seems to tend toward belief that the supply of diesel fuels may become more limited and the price higher, and, furthermore, that the effect may be felt most in grades showing the good ignition quality required by high-speed engines. This is predicated on probable continued high crude prices and changes in refining economics. The net result may well be a reasonably good supply of catalytically cracked oils, of fair ignition quality, and a reduction in supply of superior straight-run fuels and inferior thermally cracked oils.

It is also anticipated that considerable development of diesel-fuel additives or "dopes" may take place. We are all familiar with the improvement in gasoline performance

DIESEL-FUEL CHARACTERISTICS



ANILINE POINT

Indicates *paraffinicity.* Test tube inside a glass jacket is fitted with aniline-point thermometer, stirrer. Equal volume of oil and aniline is heated to clear solution and is cooled until mix becomes cloudy from separation. Temperature at which this occurs is the *aniline point*

GRAVITY

Specific gravity is ratio of oil density to density of distilled water. *API gravity* is an arbitrary scale related to specific gravity by formula (text). Specific gravity is determined by hydrometer and the observed value is corrected from test temperature to standard 60 F

FLASH POINT

Pensky-Martens closed tester consists of brass cup with a special cover carrying a thermometer, stirrer and flame-exposure device. Stove heats oil and as temperature rises, test flame is applied at regular intervals. *Flash point* is temperature of first flash

POUR POINT

Test jar fits into glass jacket, resting on disk of cork or felt. Cooling bath around jacket holds desired temperature. As oil cools it is examined. Cloud point is temperature at which haze first shows; pour point is lowest temperature at which oil is still able to flow

SEDIMENT

By extraction, sediment alone may be determined. Flask with condenser and alundum extraction thimble suspended from it, is on hot plate. Sample goes in thimble and is extracted with 90% benzol. Remaining sediment in the thimble is then weighed

resulting from addition of tetraethyl lead. Numerous chemicals produce a similar improvement in diesel-fuel characteristics. Organic nitrites, such as amyl nitrite, some amines and complex organic nitrogen compounds, and more recently, organic sulphur compounds have been tested. It is not yet known how much such treatment would add to the cost of diesel fuel but ignition-quality boosting by use of additives seems to offer real possibilities.

FUEL SPECIFICATIONS

So much for the production side of the diesel-fuel picture. How about purchasing? It is customary for the builder of an engine to recommend that its fuel conform to a given specification. Naturally, these differ widely because of differences in engine characteristics and in the opinions of the engineers preparing the specifications. There have been a number of efforts to arrive at standard specifications for various engine classes but there is today no commonly accepted standard.

To measure the various characteristics of fuel oils, several tests have become standard practice. Some of these are illustrated on the preceding page, with a brief description. Most of the tests have been standardized by the American Society for Testing Materials and the complete procedures may be found in "ASTM Standards on Petroleum Products and Lubricants", issued annually. For most users, it is enough to know the general purpose of the tests and significance of the results.

The table on this page lists the characteristics usually covered in specifications and states briefly their meaning. It can be seen that many of these refer to factors affecting combustion while some relate to general handling characteristics. It can be seen also that for some factors it is necessary to establish a range within which the fuel must fall to be satisfactory while for others it is only necessary to specify minimum values.

COMBUSTION FACTORS

Of the combustion factors, ignition quality probably should rank first in importance, particularly for high-speed engines. Measurement of *cetane number* in a test engine with variable compression ratios is the best indicator of ignition quality yet developed. As a simpler procedure, use of the *diesel index* has been suggested. This figure is obtained by multiplying the *aniline point,* in degrees F, by *API gravity* and dividing the product by 100.

The amount of *carbon residue,* as determined by the *Conradson* method, is believed to influence combustion and fuel consumption and although there is some question as to how much of the effect traces back to ignition quality it is considered wise to limit Conradson carbon percentage. This determination also serves as a check on the amount of high-boiling-point fractions in the fuel. Permissible maximum amount of carbon residue depends largely on engine size and speed.

Viscosity affects injection-system performance and spray pattern although modern injectors are not acutely sensitive to this factor. Broadly speaking, low-viscosity fuels give fine atomization with broad dispersion but shortened penetration, while high viscosity fuels offer greater resistance to atomization. Some lubrication quality is desirable in the fuel.

Ash, water and *sediment* all represent impurities which should be held to a minimum for good performance. However, it is unusual for properly refined fuels to contain undesirable quantities and most such contamination usually occurs between refinery and engine.

Although *sulphur* undoubtedly has caused corrosion of steel in exhaust systems, particularly during intermittent or idling operation, the consensus seems to be that it is not an important factor in normal operation.

From the standpoint of handling from storage to engine, *viscosity, pour point* and *flash point* must be considered. Viscosity is a rough measure of pumpability and pour point indicates effect of temperature on ability to flow. This latter is of importance only where low winter temperatures may be encountered. Flash point indicates relative fire hazard involved. It is fixed by law in some states and is often specified in insurance company regulations.

Specific gravity is a rough measure of oil grade. It is usually expressed in degrees API:

$$\text{API gravity} = \frac{141.5}{\text{Specific gravity}} - 131.5$$

Convenient tables are available for making conversions.

HOW FUEL CHARACTERISTICS AFFECT DIESEL OPERATION

CETANE NUMBER	**Indicates ease with which fuel ignites and rapidity with which it burns when injected. In high-speed engines, where ignition-delay is critical, it may prove most important characteristic**
DISTILLATION TEST	**Shows whether oil is an overhead product or contains some of heavy ends of refining process, which may burn poorly**
ANILINE POINT	**A measure of paraffinicity, aniline point is combined with API gravity to make the *diesel index* for estimating ignition quality without CFR engine tests**
CONRADSON CARBON	**Indicates amount of high-boiling-point fractions likely to cause carbon deposits**
VISCOSITY	**Influences injection-system performance to some extent, also handling from storage tank. Minimum needed for lubrication**
ASH	**Commonly believed to cause cylinder wear; ash content of today's refined fuels is very low**
WATER, SEDIMENT	**Water may cause irregular operation, particularly at high-speeds. Sediment causes wear**
SULPHUR	**Effect is debatable; often blamed for corrosion of exhaust system. Not a major problem**
POUR AND CLOUD POINT	**Indicate temperature at which oil flows. Important from standpoint of cold-weather handling**
FLASH AND FIRE POINT	**Of importance only in connection with fire hazard. Minimum fixed by law in some states and also by insurance regulations**
SPECIFIC GRAVITY	**Once thought a major consideration, gravity only gives rough indication of fuel grade**

COMBUSTION CHAMBERS

Because the diesel handles the entire job of vaporizing, igniting and mixing inside the cylinder in an extremely short time, the provision of conditions essential for good combustion becomes paramount. What are these conditions and how are they attained in practice?

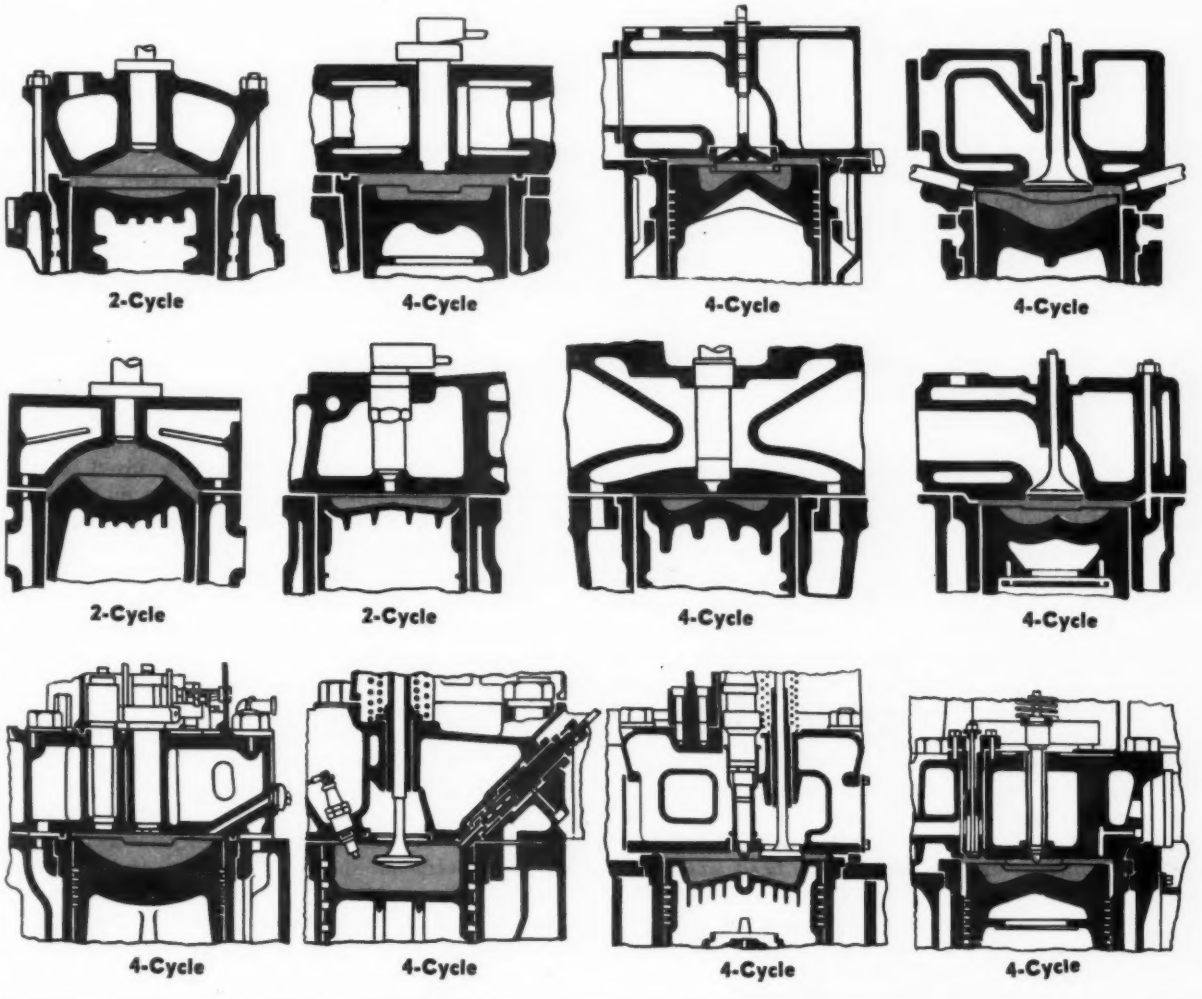
Remember that nothing burns unless or until it is a gas. This means that the liquid fuel must be vaporized before it will start to burn. Compression of the air charge in the cylinder provides heat for vaporizing but heat alone is not enough if the fuel is to be completely vaporized, and burned, in the space of a few hundredths of a second or even a few thousandths of a second in a high-speed engine. Vaporization can take place only from the surface of the liquid-fuel mass; for the extremely rapid vaporization required the only answer lies in breaking the fuel mass into a large number of small particles, each presenting surface to the heat. Also, particles must spread over as large an area as possible to bring each particle into contact with the heated air and to keep particles from being blocked by the gas generated by themselves and the surrounding particles.

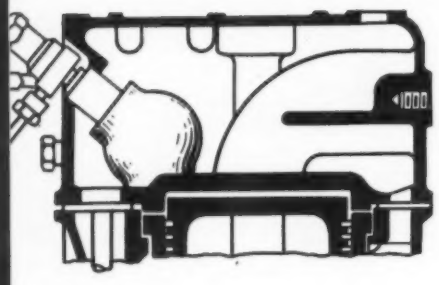
Emphasis on the importance of vaporization should not lead to falsely picturing the combustion operation as one in which fuel turns to gas, the gas mixes with air and the whole mixture is brought to the ignition temperature. Actually, while conditions like this exist at times, particularly during the ignition-delay period, they are undesirable because from this kind of burning comes knock and rough running.

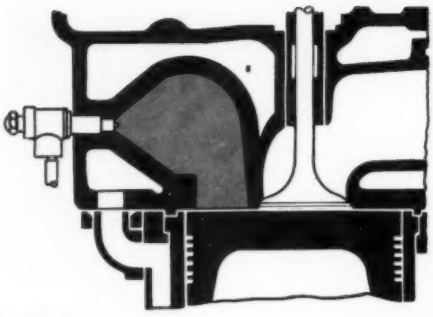
Under proper conditions, vapor ignites virtually as it forms, combustion proceeding directly from the surface of the fuel droplet. The steps of vaporization, mixing and ignition still occur, but with extreme rapidity and in thousands of individual and scattered spots. Each particle traces an essentially separate path, and, as it goes, absorbs heat, throwing off vapor which combines with surrounding air molecules. The process might be imagined as resembling a shower of miniature meteors, trailing fiery gases in their wake.

As long as the hurtling particles meet fresh supplies of oxygen, burning continues. Motion through the air removes burned gases and exposes an ever-fresh surface to the oxy-

TYPICAL OPEN COMBUSTION CHAMBERS

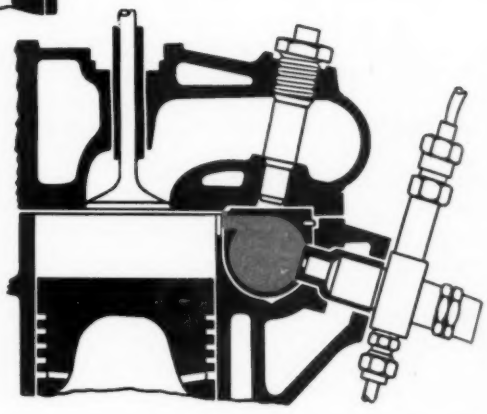






Diagrams at left show two designs having the turbulence chambers in the cylinder head. Unit below has turbulence chamber located at one side of the cylinder block. At upper end of its stroke, piston restricts orifice leading to chamber

TYPICAL TURBULENCE-CHAMBER DESIGNS



Fuel is injected into an auxiliary chamber, separated by an orifice or throat from the cylinder. This auxiliary chamber, which contains virtually the full cylinder charge at end of compression, is shaped to create turbulence. Most approximate a sphere in shape and may be located in the cylinder head or at one side of the cylinder block. In operation, piston forces the air charge into the turbulence chamber, setting up a rapid rotary motion. Velocity through the throat increases as piston rises, reaching a peak somewhat before top center. Fuel injects into turbulent air currents and good mixing results

gen until the particle is completely consumed. But oxygen supply in the cylinder is definitely limited and each succeeding particle of fuel finds an atmosphere weaker in oxygen than did its predecessors and those arriving toward the end of the process find considerable difficulty in searching out the oxygen needed for rapid and complete combustion. The process thus tends to slow up during the latter stages, unfavorably affecting power and economy.

Thus, successful combustion depends on: (1) fine atomization, (2) high temperature for prompt ignition, (3) high relative velocity between fuel and air particles, and (4) good mixing of fuel and air particles. Atomization, penetration and dispersion of the fuel depend largely on the injection system. Compression ratio, cylinder dimensions, and cooling arrangements determine temperature conditions, while mixing depends on proper relation of injection pattern, air-intake system and the shape of the combustion space formed by the cylinder head, the cylinder walls and the piston crown.

AIR-INJECTION PRINCIPLE

Early diesels used the *air-injection* principle. In simplest terms, some form of pump delivered the oil charge to a *fuel valve;* an air compressor supplied air at about 900 psi to this same valve. At the proper moment in the engine cycle, the fuel valve opened, permitting high-pressure air to rush into the cylinder, taking oil with it. Passage through the fuel-valve nozzle broke the oil into fine, foglike spray. Furthermore, the energy of the expanding air served to carry the fuel particles into the combustion space and set up a turbulent condition which insured necessary contact between fuel and air particles.

Air-injection systems with properly designed nozzles operate satisfactorily in the simplest possible combustion space—that formed by a flat cylinder head and piston crown. They will handle a wide range of fuels, including heavy residuals, tar oils and other low-grade products. However, the high-pressure air compressor represents a mechanical complication and power required to operate it reduces net engine output and economy. Today, air-injection engines are installed to handle low-grade fuel oils.

The basic idea of mechanical injection, now almost universally used, predates the diesel, having been employed in early low-compression oil engines. Difficulty of designing and producing pumps and nozzles that would operate satisfactorily at the high injection pressures required for diesel work delayed commercial application until the 20's.

SOLID-INJECTION PRINCIPLE

Mechanisms used in solid-injection practice (POWER, June, 1944, pp 373-388) differ, but all follow the same basic principle—the fuel is put under pressure mechanically and this pressure (1000 to 10,000 psi or higher) atomizes the oil in its passage through the nozzle. Only the energy thus imparted to the drops is available for *atomization* (fineness of spray) and *penetration* (distance particles travel). These requirements are contradictory to some extent and therein lies one part of the problem.

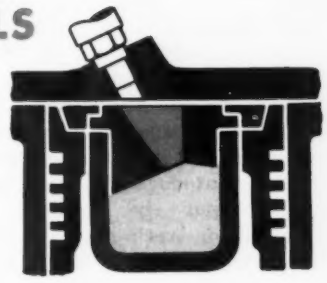
It is easy to produce a spray of almost any desired fineness and if this were all that is required there would be no problem. To be effective, a spray must have penetration. It is of no use to produce a spray which, by reason of its fineness, fails to get away from the neighborhood of the nozzle and hangs about in a cloud instead of seeking air with which to burn. To obtain the penetration desired, we must impart sufficient energy to the droplets to overcome the resistance of the very dense atmosphere into which they are injected.

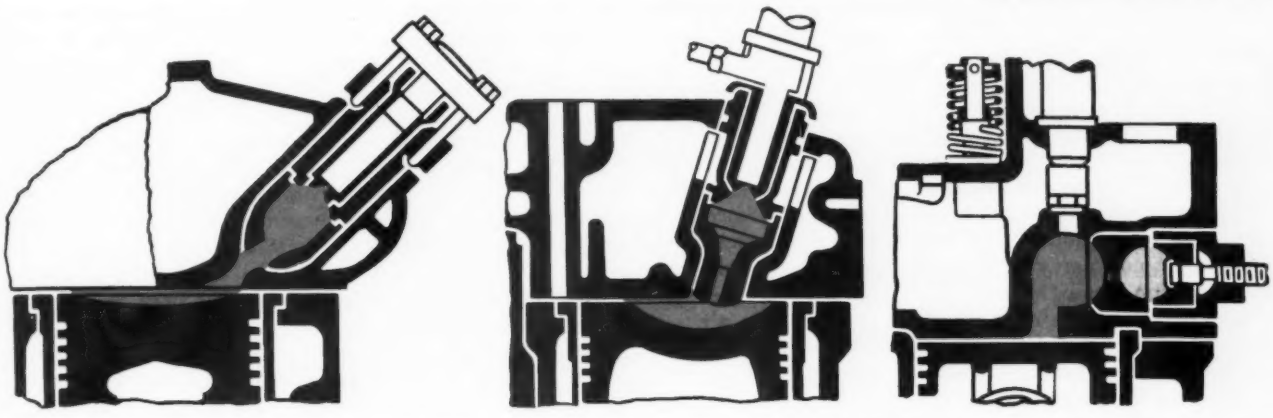
In atmospheric air, high-pressure jets carry far, but air at 500 psi is extremely dense and in an incredibly short time the globules that start out like rockets stop dead and fall down devoid of energy. Energy needed for penetration can come from increasing the size and weight of the particles or increasing their velocity. Which method is chosen depends on the characteristics of the combustion chamber. The relation between injection-system characteristics and the combustion process will be brought out more clearly as we look at the other factors involved.

Insuring conditions suitable for prompt ignition means, in the main, bringing temperature up to the needed level.

PRE-COMBUSTION CHAMBERS, AIR CELLS

Pre-combustion chambers, below, do not contain full air charge but only about one-third of it. Fuel starts to burn in presence of insufficient air. Excessively rich mixture tends to explode, throwing unburned fuel into main chamber and mixing it thoroughly with remaining air in air-cell system, space in piston or head traps air during compression. As piston starts down, pressure difference causes air in cell to flow out into combustion space, creating turbulence. At right is a simple air cell; at right below is an air cell with a turbulence chamber





The important factors are compression ratio and engine size. In a small-bore engine, the surface of the combustion space is large relative to its volume, making rate of heat loss greater. Such engines usually operate at high speed, reducing the time interval during which heat may be lost on each compression stroke. This tends to offset the effect of high surface-volume ratio, but not entirely and, in general, small-bore high-speed engines operate at higher compression ratios.

Another important reason for higher compression ratios in high-speed engines lies in the extreme shortness of the time available for combustion and hence the necessity of reducing ignition delay to an absolute minimum. Cooling arrangements may be designed to remove less heat in the combustion-chamber area, thus helping to maintain high temperature where it is needed.

AIR MOTION ESSENTIAL

The remaining essential factor in combustion is air motion, necessary to good mixing. Most combustion spaces, even the simplest, produce some turbulence and in engines operating at low or medium speeds and fairly large cylinder bores, lack of air motion characteristic of air-injection has presented no serious problem. When it became desirable to build engines for higher speeds and with smaller cylinder dimensions, designers displayed much ingenuity in developing chambers that play an important part in preparing the fuel charge and producing the conditions required for complete combustion in the fantastically short time available. Let's trace briefly the development of these designs from the classic "open" chamber of early diesels.

An *open* combustion chamber may be defined as one in which, at time of injection, all air is contained in a single space. It thus includes the simplest possible arrangement, previously mentioned, consisting of a flat cylinder head and piston crown. The open system is also called *direct injection,* because the nozzle sprays right into the cylinder space, and the space is often called a *quiescent* chamber, because of the relative lack of turbulence.

The fuel injector is usually located at the center and fitted with a number of orifices arranged to distribute the fuel throughout the combustion space. Some idea of the problem involved can be gained from the fact that with a flat cylinder head and piston crown, the combustion space of a 12x10-in. engine is a disk 10 in. in diameter and about 0.8 in. deep. Oil must be sprayed into this shallow space in such a way as to meet all the air but without impinging too heavily on piston or cylinder walls.

While both air and fuel are in motion in all engines, in the open-chamber types fuel motion predominates and on it largely depends the nature of combustion. Fuel is injected in a number of jets disposed to give the best possible coverage of the space. These jets follow more or less definite paths, with air space between, but as finer particles lose velocity the jets bush out and the distribution is better than might be imagined.

To help bring fuel and air together, designers have made many adaptations from the simplest form of open chamber. The top of the piston crown is often made concave and sometimes is shaped so that the combustion space becomes essentially hemispherical. In such designs, the piston approaches the cylinder head closely, only necessary mechanical clearance being allowed. Such changes from the flat disk-shaped combustion space tend to make the job of establishing a good spray pattern easier. In some cases, designers have placed nozzles at one side or at both sides.

USING NORMAL AIR MOTION

Improved mixing can be brought about by air currents which cut across the oil sprays, breaking them up and dispersing the particles in a more or less turbulent fashion. Thus the designer of open combustion chambers tries to make use of the air motion set up when air enters the inlet port and such motion as might be set up during compression. By coordinating shape and arrangement of piston crown, inlet port and valve, it is possible to introduce a turbulent effect. In 2-cycle engines, swirling action of tangential scavenging ports creates vigorous turbulence, which continues through compression and combustion periods.

The diagrams on page 89 illustrate the wide variety of open combustion chamber shapes.

In general, the open combustion chamber finds widest use in medium- and large-bore engines operating at low and medium speeds. It represents the greatest simplicity in design and manufacture. All-around performance, particularly at constant speed, is good. Although injection pressure must be relatively high for good penetration, compression ratio can be relatively low and starting characteristics are good. Rate of pressure rise may be high in open-chamber engines operating at higher speeds.

HIGH-SPEED PROBLEMS

Difficulty is encountered when high maximum speed and a wide speed range are desired, as in automotive practice. Correct proportioning of the spray is of major importance and the speed change unbalances it. The result is incomplete combustion and a blackened exhaust. In this connection it is worth noting that in a diesel, the overcharging of only a small part of the combustion chamber will produce a dirty exhaust. This even occurs in cases where the total fuel injected is insufficient for the available air.

Limitations on the suitability of open chambers for small-bore high-speed engines have led to development of a number of specialized designs which may be grouped into four main classes: (1) turbulence chambers, (2) precombustion or antechambers, (3) air cells, and (4) energy cells. Let's look at each in turn.

In turbulence-chamber designs, fuel injects into an auxiliary chamber, separated from the cylinder by an orifice or throat. This auxiliary chamber, which holds virtually the full cylinder charge at end of compression, is shaped to create highly turbulent conditions and is thus usually called a turbulence chamber. The sections above show typical designs.

Most turbulence chambers approximate a sphere in shape and may be located in the cylinder head or at one side of the cylinder block. They are usually located to leave ample space for inlet and exhaust valves; the fact that the fuel nozzle is in the turbulence chamber rather than at the center of the cylinder head helps to make space available for large main valves.

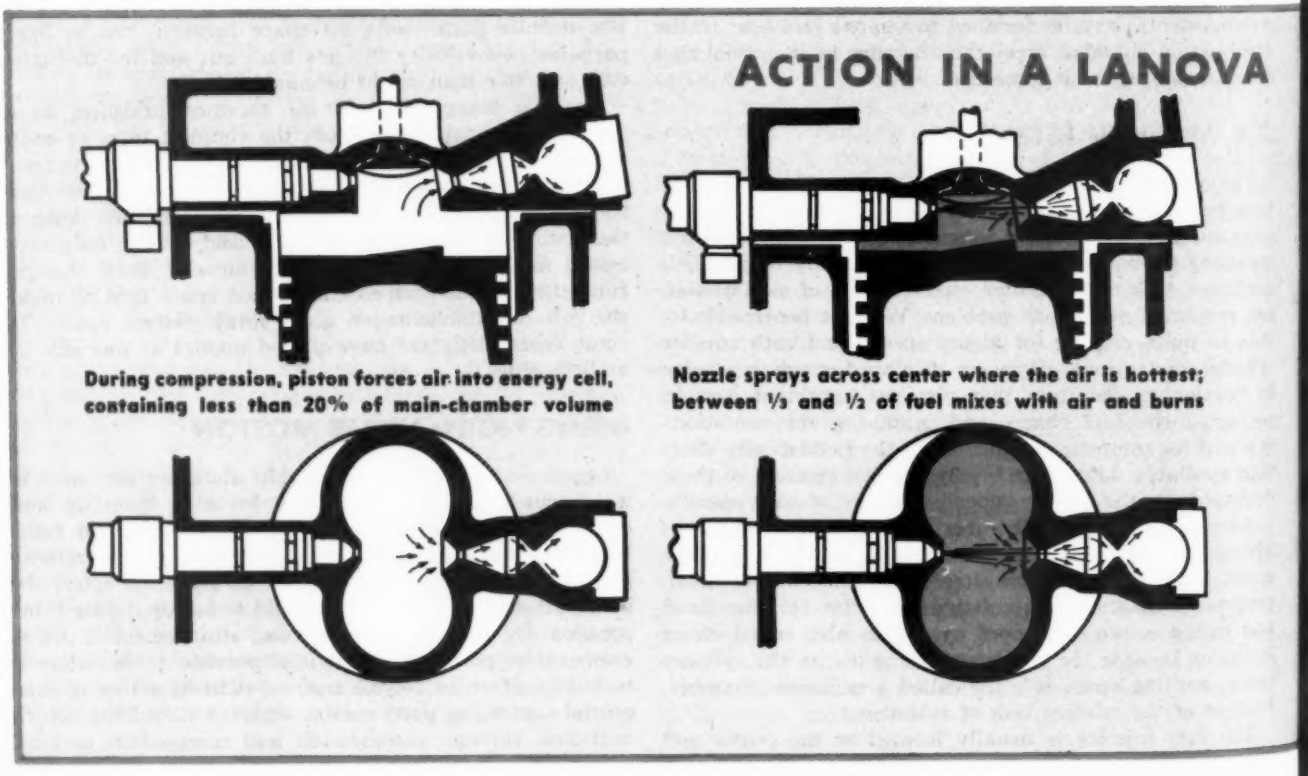
In operation, the piston forces the air charge into the turbulence chamber, setting up a rapid rotary motion. Velocity through the throat increases as the piston rises, reaching a peak somewhat before top center. In one design, with the chamber in the cylinder block, the piston at the upper part of the stroke reduces the throat area, increasing the maximum velocity and bringing the time of peak velocity closer to top center. The fuel nozzle, which may be single-orifice, pintle, or multiple-orifice, injects the fuel into the turbulent air currents and good mixing results as the combustion takes place.

Turbulence-chamber design proves well suited to high-speed engines (actually used on units running at higher than 2600 rpm) and high bmep's may be obtained. Both rate of pressure rise and maximum pressure are moderate. Injection pressure can be low and ability to use a single-hole nozzle proves advantageous in small engines where amount of fuel injected is minute. The objection that in flowing through the throat the air loses heat, making the engine hard to start when cold, may be met by arranging for a low rate of cooling at the throat or by employing a lining which is separated from the head or cylinder casting by a thin air space.

PRE-COMBUSTION CHAMBERS

At first glance, the pre-combustion-chamber design seems much like the turbulence-chamber arrangement just discussed. However, the basic principle differs markedly. In the pre-combustion-chamber system, the auxiliary chamber does *not* contain the full air charge but only a part of it, the remainder being in the cylinder space, as shown in the illustration on page 91, which includes two widely known pre-combustion-chamber designs.

Essentially, the pre-combustion chamber provides a quiet space in which the fuel starts to burn in the presence of an insufficient amount of air. This excessively rich mix-


ACTION IN A LANOVA
During compression, piston forces air into energy cell, containing less than 20% of main-chamber volume
Nozzle sprays across center where the air is hottest; between ⅓ and ½ of fuel mixes with air and burns

ture tends to explode, throwing the unburned fuel into the main chamber and mixing it thoroughly with the remaining air. The pre-combustion chamber is usually more or less cylindrical in shape; the fuel nozzle lies on the chamber's long axis and directs the oil spray at the throat. The chamber is usually watercooled and contains about one-third the clearance volume.

Pre-combustion chambers are used on engines operating up to about 2000 rpm; they offer particular advantages where lack of sensitivity to fuel quality is desired. Bmep is somewhat limited, compression ratio must be relatively high to insure starting ease and fuel consumption may run slightly higher than with other types. However, for the services in which most pre-combustion-chamber engines are used, ability to handle a wide range of fuels outweighs other considerations.

AIR-CELL SYSTEMS

The air-cell system was developed by Franz Lang who was associated with Dr Diesel in the commercial development of the air-injection diesel. He felt that there was a market for high-speed diesels that could not be reached with air-injection engines. Turning to mechanical injection, he early encountered combustion difficulties at high speeds and to overcome them developed the Acro system, using an air cell.

In such a system, the nozzle injects fuel directly into the main combustion space, where burning starts. A space is provided in the piston, or in some cases in the cylinder head, in which air is trapped during the compression stroke. This air is at close to maximum pressure when the piston starts its downward stroke and pressure in the main combustion space starts to drop. The pressure difference between the air cell and the cylinder causes the air in the cell to expand and flow out into the main combustion space where it creates additional turbulence and insures complete burning of the fuel charge. The energy trapped in the air cell is considerable and the turbulence resulting from its release is greater than might be expected.

The diagrams on page 91 show an air cell alone and combined with a turbulence chamber. It may also be combined with a pre-combustion chamber.

One disadvantage of the air cell lies in the fact that a portion of the air remains trapped in the cell and takes little or no part in the combustion. Compression ratio must be fairly high and maximum pressure is apt to be high. Reasonably high bmep may be obtained, rate of pressure rise is moderate and injection pressure can be fairly low. In general, the air cell in combination with a turbulence or pre-combustion chamber seems superior to the air cell with an open combustion system.

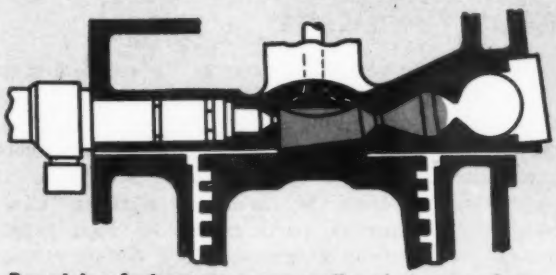
Out of another series of investigations by Franz Lang came the Lanova system, employing a so-called *energy cell*. Another system using an energy cell – the Ramsey – was developed in this country.

Energy cells resemble air cells and the two are often confused. The distinction is made that fuel is blown into the energy cell and burns there, using the air in the cell; the products of combustion blow back into the main chamber to create turbulence. It can be seen that this differs considerably from the air-cell system in which the cell simply stores and gives up an air charge. A major advantage claimed for the energy cell is that combustion in the cell creates a higher pressure and thus greater turbulence, and leaves no idle air in the cell.

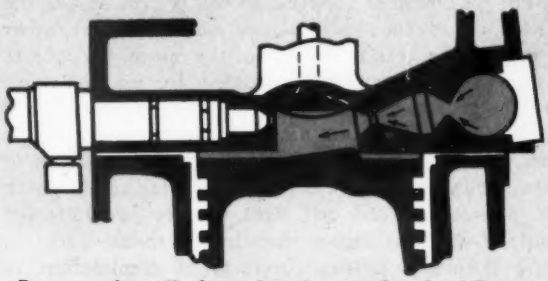
ENERGY-CELL OPERATION

Operation of energy-cell systems can best be understood by studying successive steps in the operation of typical arrangements. Although there are several modifications of the Lanova system, that with a double-lobe main chamber finds wide use. As can be seen from the diagrams below, the main combustion chamber consists of two lobe-shaped spaces cast in the cylinder head, forming a figure 8, with inlet and exhaust valves opening into them. The fuel-injection nozzle lies horizontally, pointing across the narrow section where the lobes join. Opposite the nozzle lies the two-part energy cell, making a slight angle with

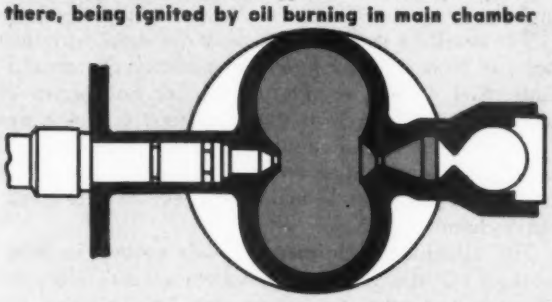
ENERGY-CHAMBER DIESEL

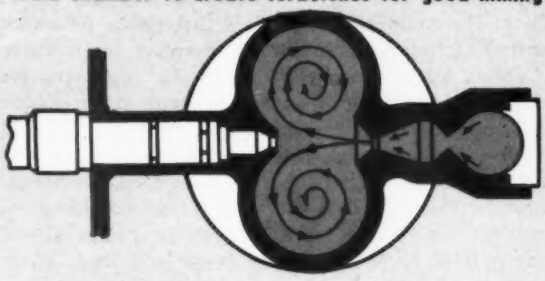


Remaining fuel enters energy cell and starts to burn there, being ignited by oil burning in main chamber



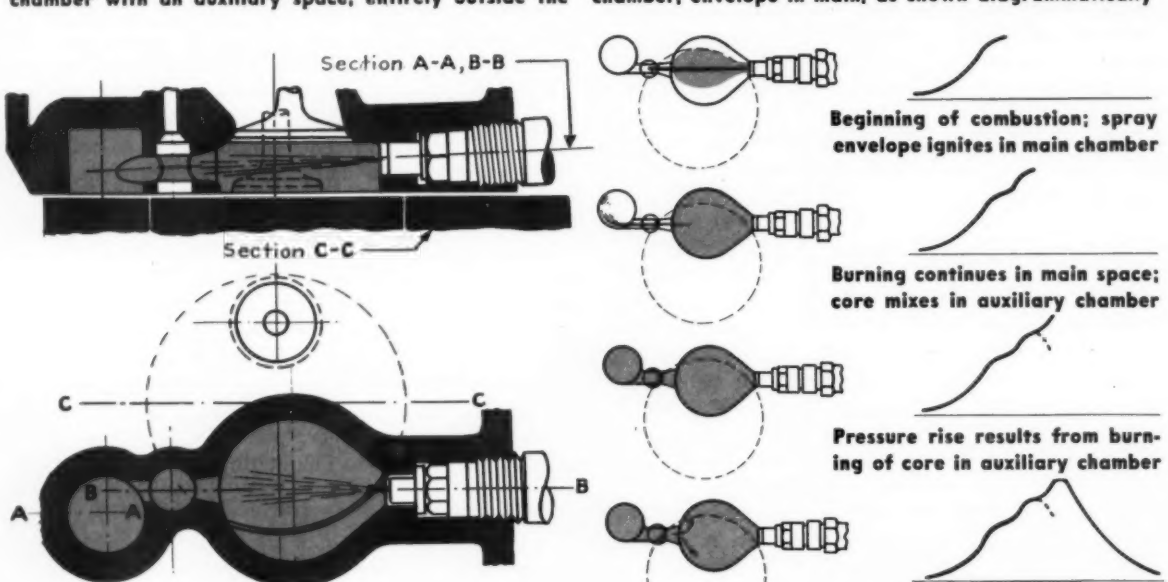
Pressure in cell rises sharply, causing backflow to main chamber to create turbulence for good mixing





RAMSEY ENERGY CELL AND ITS ACTION

Main combustion chamber, roughly shaped to envelope of fuel spray, is cast into head with a small sector outside the cylinder bore. A passageway connects this chamber with an auxiliary space, entirely outside the cylinder bore. Plug valve in passage permits closing off auxiliary chamber to increase compression for fast starting when cold. Core of fuel spray burns in auxiliary chamber, envelope in main, as shown diagrammatically



Beginning of combustion; spray envelope ignites in main chamber
Burning continues in main space; core mixes in auxiliary chamber
Pressure rise results from burning of core in auxiliary chamber
Backflow from auxiliary chamber helps create turbulence for mixing

the horizontal. The volume of the energy cell varies from about 7 to 18% of the main-chamber volume, in contrast to the air-cell system, in which the cell may contain a large percentage of the total compression volume. The two restricted openings of the energy cell permit control of the time and rate of injection of the turbulence-creating blast from the cell into the main combustion space.

Referring to the series of diagrams, the piston forces air into the energy chamber. The nozzle sprays oil across the main chamber in the direction of the energy-chamber mouth; traveling across the center of the space, fuel comes in contact with hottest air, uncooled by contact with cylinder walls. Between one-third and one-half the fuel charge mixes with this hot air and burns at once. The remainder of the fuel enters the energy cell and starts to burn there, being ignited from the oil burning in the main chamber. Pressure in the cell rises sharply to 1100-1400 psi, about 300-600 psi higher than in the main space.

Pressure difference causes products of combustion to backflow at high velocity into the main combustion space, setting up a rapid swirling movement of fuel and air in each lobe of the main chamber. This turbulence promotes the final fuel-air mixing and insures complete combustion.

The Lanova system proves suitable for high rotative speeds, permits obtaining high bmep's without excessive maximum pressure in main combustion space or too-rapid pressure rise. Compression ratio need not be high and good fuel economy can be obtained. However, particular pains must be taken to find the proper size and shape of energy cell for a given bore, stroke, and rpm, especially if the engine must operate at variable speed and load, which is characteristic of many high-speed-engine fields.

The diagrams above illustrate the energy-cell or dual-combustion system usually called the Ramsey system. The main combustion chamber, roughly shaped to the envelope of the fuel spray, is cast into the cylinder head, with a small sector outside the cylinder bore, as can be seen in the plan view. A passageway connects this chamber with an auxiliary chamber, which is entirely outside the cylinder bore. A plug valve in the passageway permits closing off the auxiliary chamber to increase compression pressure in the main chamber for easier starting in cold weather.

RAMSEY PRINCIPLE

The injection nozzle lies horizontally and fuel is sprayed across the top of the piston. The pintle-type nozzle operates at 1650-1850 psi, giving a conical spray consisting of a rather coarse partially atomized core with an envelope of finely atomized spray. The spray core is directed into the passageway between the main and auxiliary chambers; consisting of heavier particles having high penetrating power, coarse spray enters auxiliary chamber unignited.

The envelope of fine spray tends to fill the main chamber and the heat quickly ignites the finely atomized particles.

The resulting pressure rise provides some turbulence and hot gas tends to flow into the auxiliary chamber. By this time, fuel in the secondary chamber has begun to burn with the air compressed there during the piston upstroke. Pressure rises in the auxiliary chamber and gas backflows into the main chamber, creating turbulence there. Combustion is completed and maximum pressure is reached in the main chamber.

The advantages claimed for this system include many of those claimed for the Lanova energy cell: low maximum pressure and rate of pressure rise, low injection pressure, and ability to obtain high bmep's. This system also retains an advantage of the open chamber — quick starting.

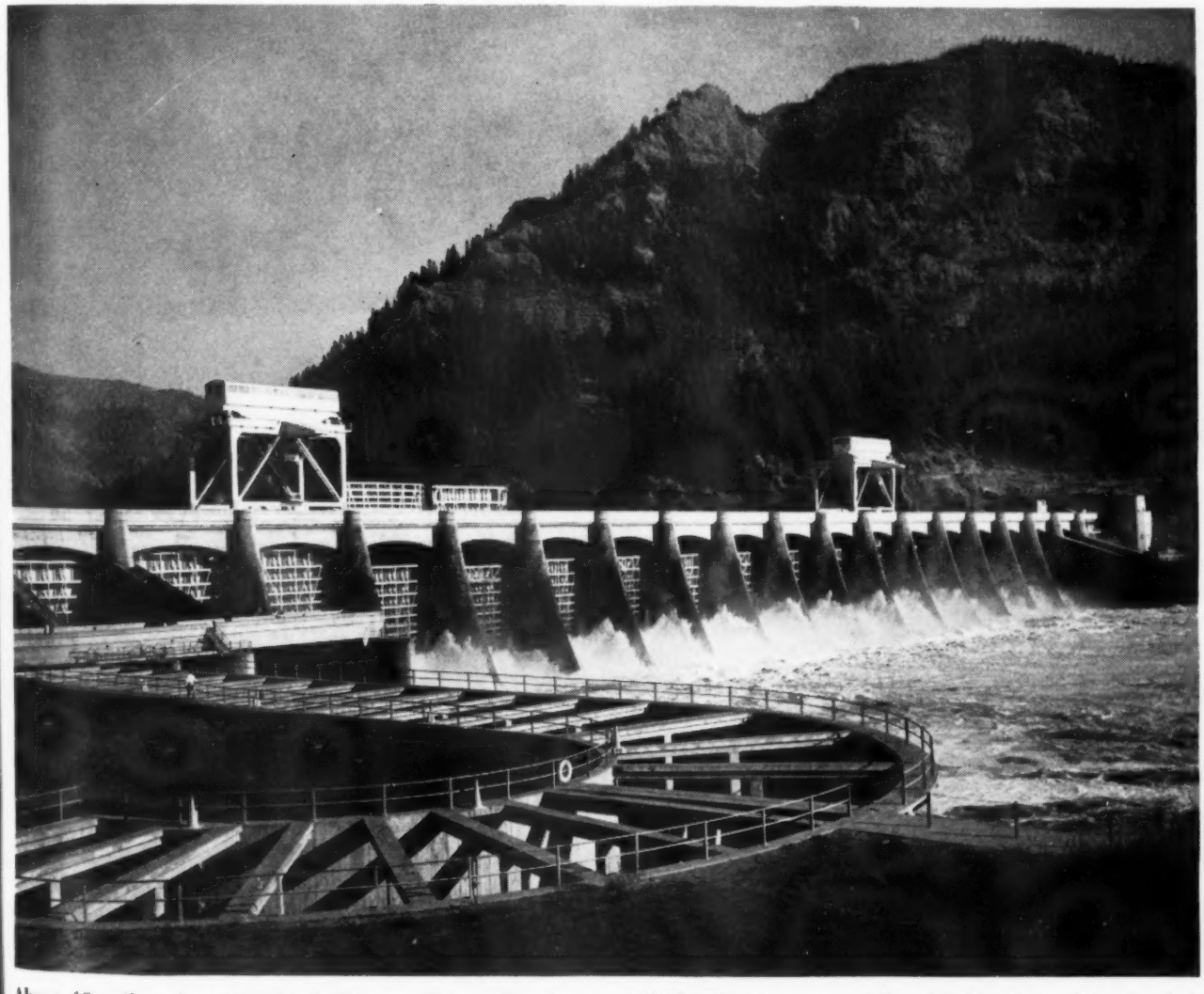
Hydroelectric
POWER GIANTS
Of the Pacific Northwest

▶On the Columbia River in the Pacific Northwest the U.S. Government is building a group of gigantic hydroelectric projects. When fully developed, this river and its tributaries can produce over 20,000,000 hp, making it one of the world's greatest sources of hydroelectric power. Already two great dams have been built, Bonneville and Grand Coulee. The former is at tidewater near Portland, Ore. The latter is 150 miles below the Canadian border, but backs the water up to it.

Bonneville dam is 1090 ft long, 170 ft high above its lowest foundation, and provides a spillway that will handle a 1,600,000-cfs flood. This power development is completed and contains ten units, two rated 66,000 and eight 74,000 hp under 60-ft head, at 75 rpm, a total of 724,000 hp. The turbines are kaplan, 5-blade propeller runners, 23 ft 4 in. in diameter.

Grand Coulee dam outstrips any structure in the world. It is 4300 ft long at its crest, 500 ft thick at its base and 550 ft high above the lowest bedrock. It forms a 10,000,000-acre-ft reservoir of which 5,000,000 are useful storage. Eventually there will be two powerhouses at the base of the dam, one on either side of the river. These will house eighteen 150,000-hp main units and three 14,000-hp service units, making an installed capacity of 2,742,000 hp. Six main units are now in operation, along with two machines borrowed from Shasta plant on the Sacramento River in northern California. After the war these two units will be returned to Shasta and Grand Coulee extended according to its original design.

(*Continued on page* 98)

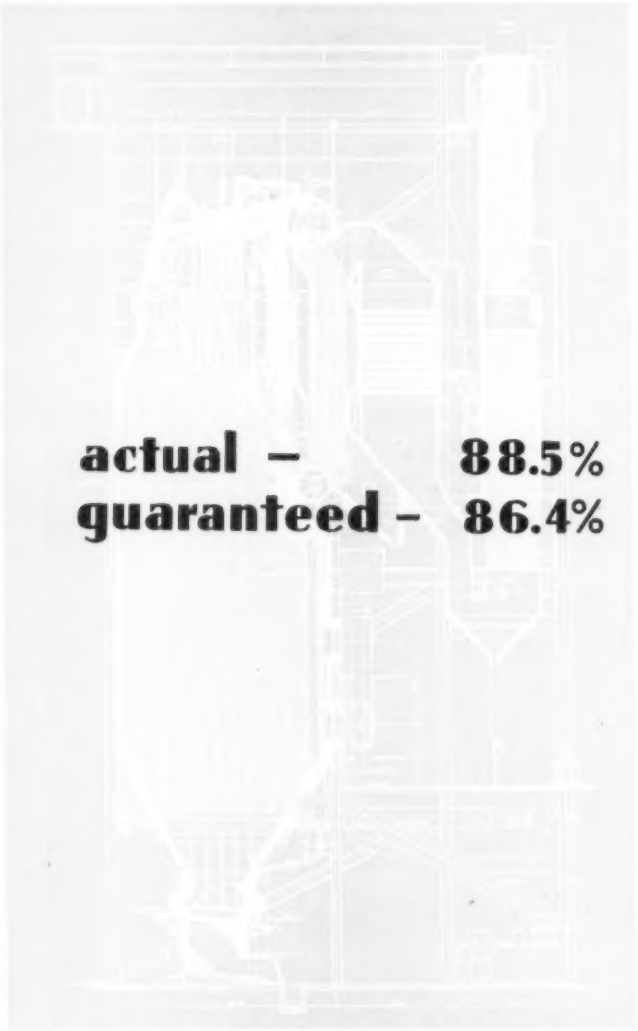


About 40 miles above Portland, Oregon, Bonneville dam blocks the Columbia River gorge to generate 724,000 hp of hydroelectric power. The circular channel in the left foreground is fish ladder that passes salmon over dam

proof that ACTUAL RESULTS from

Actual results from Riley Steam Generating Units almost invariably exceed guarantees because Riley designs always include ample heating surfaces and furnace volumes to afford these plus values — component parts are never of a size to just give guaranteed performance. On 38 recent tests actual efficiencies exceed guaranteed efficiency by 1.6 points. A few cases are enumerated herein.

Riley users are saving thousands of dollars in fuel cost over anticipated savings. The purchaser of Riley Units can not only have complete confidence that Riley guarantees will be fully met but can expect actual results to exceed guaranteed performance.



UNION ELECTRIC CO. OF ILL., Venice, Ill.
2—400,000 lbs./hr. Riley Units
1000 lbs. Pressure 915°F. Temp.

PENNSYLVANIA EDISON CO., Williamsburg, Pa.
300,000 lbs./hr. Riley Unit
975 lbs. Pressure 900°F. Temp.

RILEY

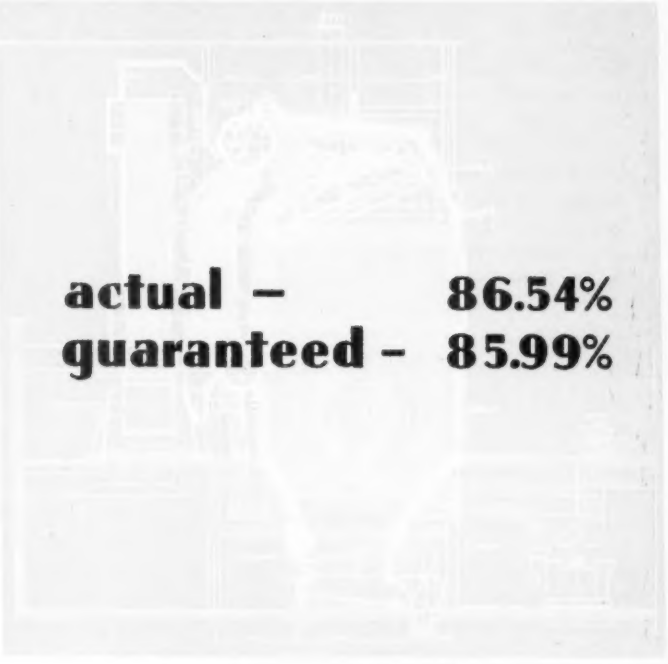
STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

t will pay you to visit modern Riley Installation

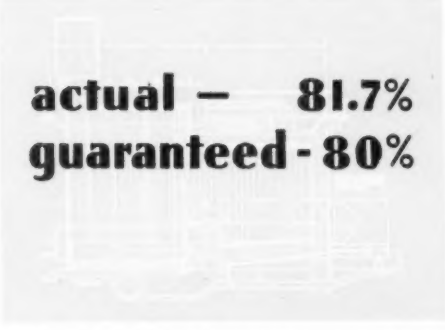
Riley Units exceed GUARANTEES

WINCHESTER REPEATING ARMS CO.
100,000 lbs./hr. Riley Unit
725 lbs. Pressure 750°F. Temp.



LARGE CHEMICAL PLANT
2—170,000 lbs./hr. Riley Units
675 lbs. Pressure 650°F. Temp.

OTTER TAIL POWER CO., Canby, Minn.
75,000 lbs./hr. Riley Unit
500 lbs. Pressure 825°F. Temp.



PET MILK CO., Coldwater, Mich.
20,000 lbs./hr. Riley Unit
120 lbs. Pressure

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

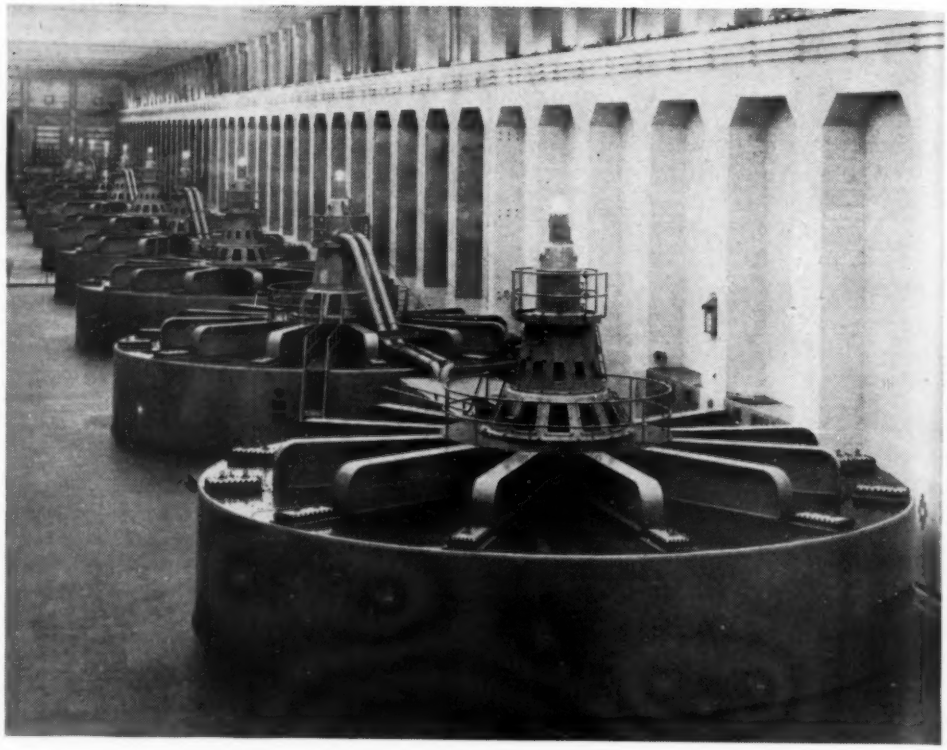
COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

efore purchasing Boiler or Fuel Burning Equipment

POWER GIANTS

(*Continued from page* 95)



Bonneville plant where there are installed two 43,200-kw and eight 54,000-kw generators, a total of 518,400 kw. Power from these machines merges with Grand Coulee power in a 2700-mile transmission network through the Pacific Northwest

Grand Coulee project (below) and Bonneville represent the first steps to develop the vast hydroelectric resources of the Columbia River. Studies made by the Bonneville Power Administration, U. S. Army Engineers and U. S. Bureau of Reclamation, indicate that more than 20,000,000 hp can be developed in this river's basin.

RUSSIA AND AMERICA

ALLIES—or else . . .

VICTORY in Europe was won only through the combined endeavor of the United Nations. Only through sustained joint effort can the fruits of that victory be reaped.

Without disparaging the truly heroic contributions of others, three of the Allies may fairly be credited with having made the major contributions to victory over the European Axis—the United Kingdom, Russia, and the United States. The close accord of these three nations is no less crucial to the accomplishment of the tasks that remain.

First of these is the war against Japan. It still requires winning. Even without any help from others, the United States could make good this victory, but the war's duration will be speeded by the marshaled effort of the United Nations.

Next, and not less important, is the task of establishing a basis for enduring peace. In this struggle our enemies are more formidable than any we have faced—national ambitions, prejudices, suspicions and distrusts, the staggering burden of tradition and debilitating cynicism born of past failure, the cleaving wedges of divergent languages, thought patterns, economic creeds and procedures—an array of difficulties as baffling as fog and as formidable as a deluge. They can be vanquished only by a continuance of the working accord between the United States, Russia, and Britain that was forged on the anvil of European conflict.

☆ ☆ ☆

This high appraisal of the decisive importance of the Big Three in determining the destiny of the United Nations organization, in no way depreciates the importance of the role to be played by France, by China, or the other freedom-seeking nations represented at San Francisco. All of us are committed to the building of a genuinely representative security organization in the conviction that by such means alone can we possibly achieve a just and lasting peace. But the strength of any international machinery will depend upon the validity of Russian-British-American cooperation. If these three are able to achieve substantial harmony of aim and procedure, a world organization that includes them can operate with effective coherence. If they pull apart, the United Nations will break up into competing and jealously hostile blocs.

This is inevitable because of the sheer weight of these three nations in the world's affairs. Between them they account for perhaps half of the world's income and from two-thirds to three-quarters of its industrial output. Once Japan has been crushed, they will control an overwhelming preponderance of the world's armed might. Each of them will wield military power on a scale quite beyond the power of any embryo security league to hold in check. Only if all three are resolved to keep the peace and to enforce it through the Security Council, can that body hope to accomplish its aim.

Although there is a tendency on both sides of the Atlantic to indulge somewhat recklessly in mutual criticism, the ties between Britain and America are too firm to be severed by any foreseeable strain. But that has not been true of our relations with Russia. Even while fighting a war in which our respective ways-of-life were at stake, the inestimable services of each to the other were rendered as friendly but independent associates rather than as fully trusted partners. Now again, as we approach the difficult and vitally important task of building a world organization and of devising a European peace, the task of our delegates is complicated by national attitudes under which each hopes for the best from the other, while fearing the worst.

But the stakes for us both—and for the rest of the world—are too high to be played for in a diplomatic poker game. Russia has no inhibitions in demanding what she wants, and our own vital interests must be stated and upheld with undeviating firmness. Yet we both must face the stark fact that few advantages that either nation might gain at the cost of dissipating the good will of our wartime association could be worth the price thus paid.

☆ ☆ ☆

The first steps toward establishing confidence lie in a frank recognition of what may contribute to the lack of it and in a definition of what can be done to restore it.

1. *Probably the greatest single area of reciprocal distrust between Russia and our own country is based on the fear of each that the other may try to interfere with its domestic, economic, and political affairs.* Each purports to see the beam of meddlesome intervention in the other's eye, while it ignores the mote in its own. Thus the Soviet Union remembers that we participated in the foreign military intervention at the time of her civil revolution, and afterwards lent our support to successive boycotts of her trade, of her gold, and of her credit needs. For our part, we remember the Soviet Union's doctrine, and

aggressive support, of revolutionary international communism.

We feel that Russia should find satisfactory evidence of our present willingness to have her develop her internal institutions as she will in the aid that we have given her during the war, and in the record of our good-neighbor policy as applied to Latin America. She, no doubt, resents our lingering suspicions in the face of her declared policy of 1941 to refrain from any attempt to influence the political or economic structure of foreign nations. Certainly, each of us will need the repeated reassurance that can come only through sustained performance by the other in the years ahead. Meanwhile, much will be gained if each will give to the other's good faith the benefit of the doubt, while it scrupulously guards its own conduct to avoid even the appearance of backsliding.

2. *A second zone of suspicion is created by those measures which each of us interprets as natural and necessary bulwarks of national security when they are our own, but as evidence of dangerously aggressive imperialism when taken by the other.* In our view, at least, such demands as we have voiced for island trusteeships or for other naval bases appear mildly conservative as compared with Soviet claims for annexation of territory and for a general orbit of influence, under governments friendly to her, throughout eastern Europe in particular.

There can be no easy solution to that problem. Bi-focal vision, by which one nation can look through a second lens ground to the prescription of another, seldom is achieved in international affairs. The success of the San Francisco Conference will provide a mechanism for international definition of principles and procedures which at least might relieve the inevitable strains. Most important will be the record of how each of us proceeds in our respective courses of action. Soviet performance thus far is highly unsatisfactory to us. While we have taken pains to clear our procedure with her, she has taken action in the Baltic, in Austria, and in Poland without even advance notice to us.

A major test of our ability to cooperate may be found in the Allied administration of conquered Germany. The proposed four-headed control of a four-way partitioned nation promises to be at best an extremely awkward mechanism of administration. At worst, it can result in continuous and dangerous bickering between the representatives of Britain, France, the United States, and Russia in the Berlin coordinating center, and in hopelessly divergent procedures in their several zones of administration. There will be a compelling need for all of us to exercise all of the wisdom and cooperative resolve that we possibly can muster.

3. *A third testing ground for the future of American-Soviet relationships will be defined by the course of Russia in our continuing war with Japan. We are not unmindful of the toll paid by the Soviet Union in its magnificent European war effort. But we still are locked in a desperate struggle with an enemy that exemplifies the Fascism which America and Russia equally denounce. And that war is being fought in an area where Russian interests are importantly at stake.*

Russia has an extraordinary opportunity to create good will by throwing her weight speedily and effectively on our side. There is no doubt but that the final Pacific settlement will generate problems comparable with those of the European peace, but it is equally certain that the continuation of the European comradeship in arms can do much to promote an enduring and confident postwar friendship.

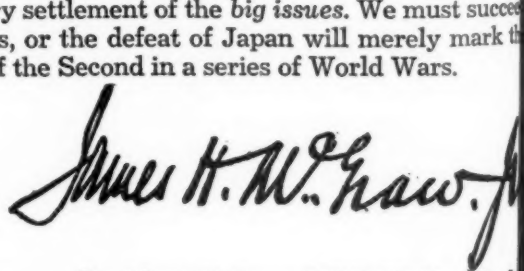
4. *A fourth, and highly important, potential source of suspicion and irritation is the intellectual blockade that the Soviet Union has maintained against the free flow of travel, intercourse, and exchange of ideas.* We can understand the genesis of this policy and the reasons for its continuance while Russia entertained a constant fear of attack by powerful enemies. But the sustained perpetuation of such a quarantine by so strong a nation as the present U.S.S.R. could not be accepted as a protective measure. Inevitably it would generate suspicion that it was rather an instrument of nationalistic isolation or even of contemplated aggression. A way-of-living, at arm's length, with a nation that maintains such intellectual quarantines is possible; any whole-hearted partnership of effort is quite impracticable.

5. *Trading between a free-enterprise nation and one that operates all foreign commerce as a government monopoly can give rise to many frictions.* That subject is too complicated for exposition here. Suffice it to say that while difficult, it is not impossible to conduct such trade with mutual advantage. We are in a position to help Russia greatly with her program of industrial rehabilitation and expansion at great saving of cost in terms of her current scale of living. In return, we must have assurance that her government monopoly trading will be conducted for commercial rather than political ends, and that it will be used to encourage rather than to restrict multilateral and non-discriminatory world trade.

☆ ☆ ☆

This is a representative list of the major areas in which misunderstanding and distrust may be generated, or allayed, in Russian-American relationships. No doubt, an equally honest list drawn by a citizen of the Soviet Union would be more heavily weighted by those features of our behavior which irritate and stimulate distrust on their side. If such a catalog were to be presented, it should receive our most searching and responsible consideration.

For it is of utmost importance that our two nations in concert with the other United Nations, learn how to get along in mutual confidence and respect. Our understanding of each other now is so imperfect that our negotiations are punctuated with continuous irritations over *little issues*. This, inevitably, will continue until such matters are submerged in the general confidence that can be achieved only through satisfactory settlement of the *big issues*. We must succeed in this, or the defeat of Japan will merely mark the end of the Second in a series of World Wars.



President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 36TH OF A SERIES

How to Plot CO_2-Excess-Air Curve for Natural Gas

In this sequel to the article in MAY POWER Editor Phil Swain explains plotting of chart from actual fuel analysis. Used with previously printed methane charts for moisture loss and dry-gas loss, this gives commercially accurate stack losses from the CO_2 and flue temperature

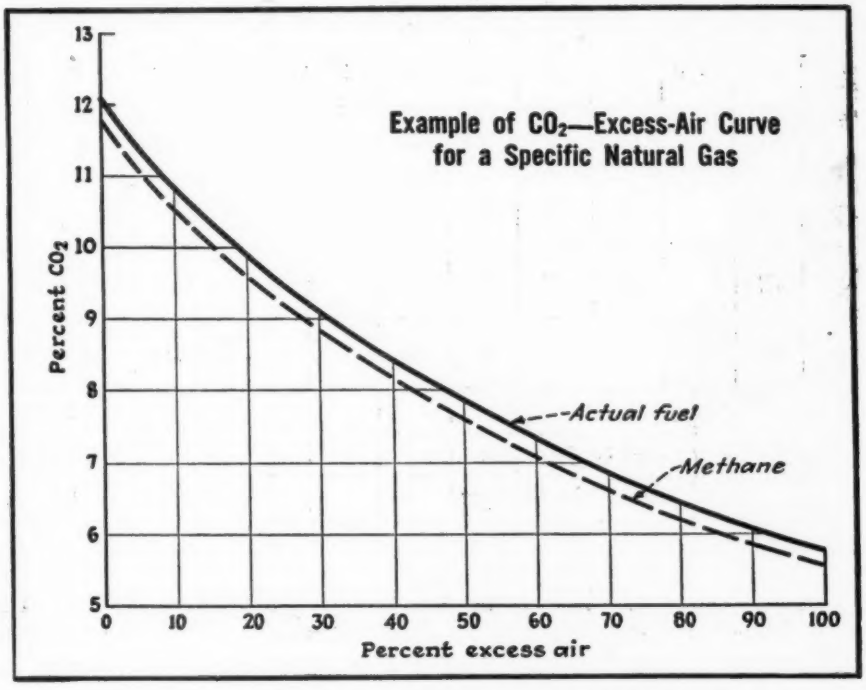


Chart gives the percentage of excess air for any flue-gas CO_2 percentage for a natural gas of the following analysis: CO_2 2.8%, CH_4 89.1%, C_2H_6 4.2%, N_2 3.9%

▶ SINCE MOST NATURAL GASES CONTAIN from 70 to 95% of methane (CH_4) the article on page 82 of May POWER developed and explained the following charts for pure methane fuel:

Fig. 1—Excess-air percentage from CO_2 percentage in flue gas

Fig. 2—Percentage moisture loss, given the flue temperature

Fig. 3—Percentage dry-gas loss from temperature difference (flue temperature minus room temperature) and excess-air percentage

It was explained that Fig. 2 and 3, while derived for pure methane, involve no appreciable error when applied to natural gases with as little as 70% methane. Fig. 1 can also be used for rough calculations with natural gas, but often this will involve appreciable error.

All ordinary commercial requirements will be satisfied if the operator of boilers burning natural gas uses Fig. 2 and 3 from the previous article along with a curve specially computed to show the relation of CO_2 percentage to excess air for the actual fuel used.

Slight daily or monthly variations in the composition of this natural gas are of no importance in this connection. Even a sizable change in the percentages of the various constituents will hardly produce a measurable change in the curve. Thus a curve derived now for an "average" analysis of the gas burned should serve equally well six months later.

One point, however, must be carefully noted. While only the curve of excess air against CO_2 need be plotted for the actual gas used, all three curves published in last month's article must be applied to the actual heat value of the fuel being burned, not to the heat value of methane.

The important constituents of natural gas are CH_4 (methane), C_2H_6 (ethane) CO_2 (carbon dioxide) and N_2 (nitrogen). Often handbooks report natural-gas analysis in terms of these four constituents and no others. If certain other minor constituents are reported in the analysis submitted, they may be handled as follows for the purpose of this curve derivation:

Constituent	*Disposal*
C_2H_2	report as C_2H_6
C_2H_4	report as C_2H_6
H_2S	neglect it
O_2	neglect it
CO	neglect it

After the suggested adjustments have been made, adjust the nitrogen until the total constituents again add up to 100%. The analysis will then be in terms of no other gases than CH_4, C_2H_6, CO_2 and N_2.

Here are the subsequent steps: Consider 100 cu ft of natural gas. Enter the cubic feet of constituents in column 2 of Table I, a form for combustion with theoretical air. Multiply by factors in columns 3, 4 and 5 to give the cubic feet in columns 6, 7 and 8 respectively (table on page 100).

Table II shows how Table I is filled out for a natural gas with 2.8% CO_2, 89.1% CH_4, 4.2% C_2H_6, 3.9% N_2. Multiply 2.8 by 1 (col 5) to get 2.8 (col 8). Multiply 89.1 (col 2) by 2 (col 3) to get 178.2 (col 6). Continue in this way until all blanks in body of table are filled.

In this case the final dry flue gas from 100 cu ft of natural gas contains 727.5 cu ft N_2 and 100.3 cu ft CO_2, 827.8 cu ft in all. The CO_2 is 12.1% of the total. Note that 12.1 is the CO_2 percentage when the given natural gas is burned with exactly the theoretical amount of air.

The theoretical air supplied per 100 cu ft of natural gas is the sum of all oxygen required and all N_2 to flue gas *except the 3.9% N_2 in the original fuel.* This theoretical air is then 178.2 + 14.7 + 668.2 + 55.4 = 916.5 cu ft. There-

1	2	3	4	5	6	7	8
Constituent	Cubic feet of constituent	Factors for			Cubic feet		
		O_2 required	N_2 to flue gas	CO_2 to flue gas	O_2 required	N_2 to flue gas	CO_2 to flue gas
CO_2		—	—	1	—	—	
CH_4		2	7.5	1			
C_2H_6		3.5	13.2	2			
N_2		—	1	—	—		—
Total							
Total in flue gas					—		
Percent in flue gas					—		

Table I – Form for computing the air volume required and CO_2 in flue gas for combustion with theoretical air

1	2	3	4	5	6	7	8
Constituent	Cubic feet of constituent	Factors for			Cubic feet		
		O_2 required	N_2 to flue gas	CO_2 to flue gas	O_2 required	N_2 to flue gas	CO_2 to flue gas
CO_2	2.8	—	—	1	—	—	2.8
CH_4	89.1	2.0	7.5	1	178.2	668.2	89.1
C_2H_6	4.2	3.5	13.2	2	14.7	55.4	8.4
N_2	3.9	—	1	—	—	3.9	—
Total					192.9	727.5	100.3
Total in flue gas					—	727.5	100.3
Percent in flue gas					—	87.9	12.1

Table II – Table I filled out for a natural gas sample analyzing 2.8% CO_2, 89.1% CH_4, 4.2% C_2H_6 and 3.9% N_2

fore if the excess air is 20%, the added volume in the flue gas will be $0.20 \times 916.5 = 183.3$ cu ft. For 40% excess air the increase is 366.6 cu ft; for 60% it is 549.9 cu ft; for 80% it is 733.2 cu ft; and for 100% excess air the increase is 916.5 cu ft.

Table III is the form for this computation. The computations of the selected problem will be clear from Table IV. For 40% excess air, for example, total volume of flue gas from 100 cu ft of fuel is $366.6 + 827.8 = 1194.4$ cu ft. Excess air cannot change the cubic feet of CO_2 produced. This must remain constant at 100.3 cu ft. so the CO_2 percentage will be $100 \times 100.3 \div 1194.4 = 8.4\%$.

The final step is to plot the accompanying chart. For purposes of comparison the dotted line, taken from Fig. 1 in the previous article, shows the relation for pure methane.

All charts used in this and the previous article should be applied only to the actual heat value of the gas used—never to the heat value of methane, unless the fuel is methane.

1	2	3	4
Percent excess air	Added volume of flue gas	Total volume of flue gas	Percent CO_2 per ——— cu ft CO_2
0			
20			
40			
60			
80			
100			

Table III – Blank form

1	2	3	4
Percent excess air	Added volume of flue gas	Total volume of flue gas	Percent CO_2 per $\frac{100.3}{}$ cu ft CO_2
0	0	827.8	12.1
20	183.3	1011.1	9.9
40	366.6	1194.4	8.4
60	549.9	1377.7	7.3
80	733.2	1561.0	6.4
100	916.5	1744.3	5.7

Table IV – Problem completed

Tables III and IV – This convenient form for computing percentage of CO_2 corresponding to various percentages of excess air starts with the results obtained in Table II

Mineral-Free Water Without Distillation

M E Gilwood and V J Calise, The Permutit Co, cite seven years operating experience with present demineralizing plants that remove dissolved solids by chemical treatment*

▶ THE SODIUM-ZEOLITE SOFTENER, first commerically introduced about 30 years ago, removes the cations, calcium and magnesium, from water by exchanging them for sodium in the zeolite. However, the resulting water softened by sodium zeolite contains an amount of sodium salts equivalent to the total cations present in the raw water. Thus, total amount of dissolved solids in the treated water remains unchanged.

The first sodium zeolites, siliceous materials, were not resistant to acids, and it was not until the development, some ten years ago, of an acid-resistant organic cation-exchange substance, such as Zeo-Karb, that it became possible to reduce the electrolyte content in water by ion exchange. An organic-cation exchanger can be regenerated either with salt brine or with sulphuric or hydrochloric acid.

After being regenerated with acid, it exchanges hydrogen for sodium, calcium and magnesium, thus producing an effluent containing hydrochloric, sulphuric and carbonic acids in amounts equivalent to the chlorides, sulphates and bicarbonates in the raw water. The carbonic acid breaks up into free carbon dioxide and water, and degasification can then remove the CO_2. The hydrochloric and sulphuric acids can be neutralized by feeding sodium carbonate or sodium hydroxide or by blending with the effluent from a sodium-zeolite softener that contains sodium bicarbonate, to form sodium chloride and sodium sulphate in the effluent. Thus, a reduction in the bicarbonate content to any desired figure is possible.

However, these methods do not reduce the chloride and sulphate content of the original water, but convert them to sodium chloride and sodium sulphate. These salts are objectionable for many applications where the equivalent of distilled water is desired. Accordingly, a method for removing the chlorides and sulphates from water was still required.

In 1935, Adams and Holmes reported the development of an acid-absorbent material that can be regenerated with alkalies and operated in repeated cycles. It removes the hydrochloric and sulphuric acids formed in the hydrogen-cation-exchange process, while the weak carbonic acid passes through unchanged and is removed by degasification. Thus, without using heat, it is possible to produce a water

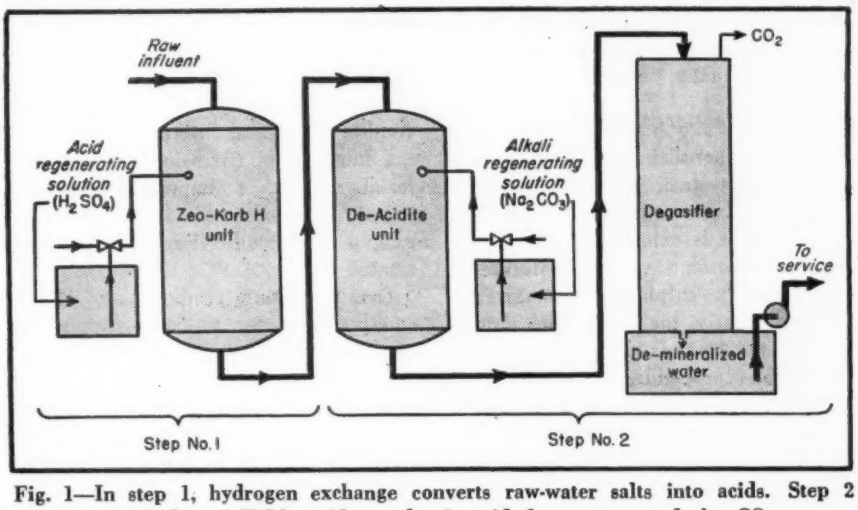


Fig. 1—In step 1, hydrogen exchange converts raw-water salts into acids. Step 2 absorbs the HCL and H_2SO_4 acids; carbonic acid decomposes and the CO_2 escapes

** Abstract of a paper delivered at the 5th Annual Water Conference, Engineers' Society of Western Pennsylvania, Oct. 30, 1944.*

Table I—Average Demineralized-Water Analysis Compared to Commercial Distilled Water

		Expressed as ppm $CaCO_3$	
		Demineralized water	*Distilled water*
Total hardness	(Ca++&Mg++)	0–2	0–15
Sodium	(Na+)	1–10	2–15
Total cations		1–12	2–30
Bicarbonates	(HCO_3−)	1–6	2–18
Chlorides	(Cl−)	0–3	0–6
Sulphates	(SO_4=)	0–3	0–6
Total anions		1–12	2–30
Usual cost, per 1000 ga		$0.01–0.20	$0.80–8.00

Table II—Cost of Demineralizing This Raw Water Is 2.9 Cents per Thousand Gal

		Expressed as ppm $CaCO_3$	
		Raw water	*Demineralized water*
Total hardness	(Ca++&Mg++)	12	0
Sodium	(Na+)	28	4
Total cations		40	4
Bicarbonate	(HCO_3−)	12	3
Chlorides.....	(Cl−)	10	1
Sulphates	(SO_4=)	18	0
Total anions		40	4

having an electrolyte content equivalent to distilled water.

The earlier acid-absorbent materials, or anion exchangers, as they are frequently called, had relatively low exchange capacity and short life, and they decomposed easily, resulting in loss of material and color contamination of the effluent. Also, they revealed a gradual deterioration in the quality of the effluent produced with repeated operation. Intensive research developed products that not only eliminate the troubles encountered with the earlier materials but, in some respects, excel the well-established cation exchangers, especially in capacity and regenerating efficiency. A typical one is the aliphatic amine resin, *De-Acidite*.

De-Acidite has operated for hundreds of cycles with only a small drop in capacity, imparting no color to the treated water and producing an effluent that remains constant in its low electrolyte content. However, the material has not the stability of Zeo-Karb, which shows no appreciable change in capacity even after many thousands of cycles and many years of service.

Regeneration Time

The demineralizing process is a 2-step series system, Fig. 1. When the cation-exchange capacity of the Zeo-Karb H unit is exhausted, it is regenerated by passing a dilute solution of acid, usually sulphuric, through the bed. Similarly, the De-Acidite unit is regenerated by soda ash. Complete regeneration procedure, consisting of backwashing, regeneration and rinsing to waste, requires about one hour for each unit and can be done automatically when desired.

Good ion exchangers alone are no guarantee of good demineralizing performance. Proper equipment design and operation are essential for satisfactory results at economical operating costs. Both the Zeo-Karb H and De-Acidite units and interconnecting piping must be of corrosion-resistant materials. This is important both to secure long life and also to prevent pickup of metallic impurities by the treated water.

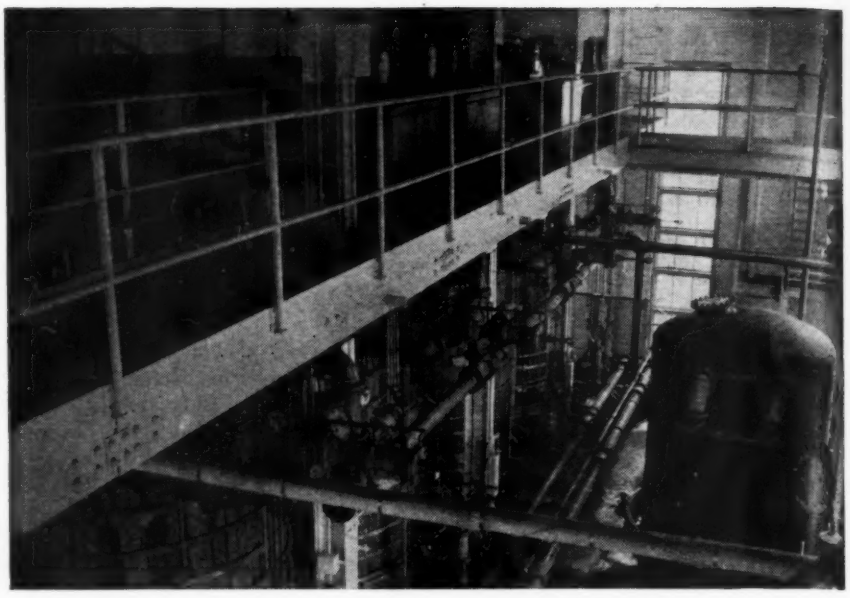


Fig. 2—To conserve critically important war materials these four large Zeo-Karb H tanks and the De-Acidite units (not shown) are of wood stave construction

Demineralizing produces an effluent equal or superior to most commercial distilled water. Table I gives a comparison of the average analyses of demineralized and commercially distilled waters. Silica is not removed. If low silica content is desired supplemental silica-removal treatment must be employed. The first commercial demineralizing plant was installed about seven years ago; since then a large number of plants have been built for a wide variety of applications.

Cost of demineralizing varies with the amount and nature of the dissolved solids in the raw water but, in general, it ranges from one to 20 cents per 1000 gal. On the other hand, cost of commercial distilled water varies from $0.80 to $8.00 per 1000 gal.

A small demineralizing unit was installed in the plant of a Southern rayon manufacturer a year ago. It is designed to produce 4 gal of water per minute. The Zeo-Karb H and De-Acidite units, each 12 in. in diameter, consist of rubber-lined steel shells with hard rubber interconnecting piping. The

(*Continued on page* 144)

Table III—Cost of Demineralizing This Raw Water Is 8 Cents per Thousand Gal

		Expressed as ppm $CaCO_3$	
		Raw water	*Demineralized water*
Calcium	($Ca++$)	201	0
Magnesium	($Mg++$)	109	0
Sodium	($Na+$)	22	5
Total cations		332	5
Bicarbonates	(HCO_3-)	221	4
Chlorides	($Cl-$)	21	1
Sulphates	($SO_4=$)	90	0
Total anions		332	5

Table IV—Quality of Demineralized Water Under Normal and Drought Conditions

		Normal (A)		*Drought* (B)	
		Raw water	*Demineralized water*	*Raw water*	*Demineralized water*
Calcium	($Ca++$)	46	0	87	0
Magnesium	($Mg++$)	13	0	73	0
Sodium	($Na+$)	90	7	186	14
Total cations		149	7	346	14
Bicarbonates	(HCO_3-)	80	4	56	4
Chlorides	($Cl-$)	24	2	209	9
Sulphates	($SO_4=$)	45	1	81	1
Total anions		149	7	346	14

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Regrooving Traction Elevator Sheave Stops Hoist-Rope Slippage

Frank Schlieff, chief elevator mechanic, McGraw-Hill building, New York City, tells how The Maintenance Co, under difficult conditions, removed a traction sheave weighing 1800 lb from a large geared freight elevator for regrooving in the shop

BECAUSE TEN YEARS' service had left the hoist ropes on one of our heavy freight elevators in poor condition the insurance inspector asked us to replace them. In addition, the old ropes slipped in their sheave grooves which were badly worn. This elevator is a geared-traction design, rated 8000 lb at 350 ft per min. It has a 40-in. V-grooved sheave for sixteen $\frac{9}{16}$-in. ropes.

Before installing new ropes we contracted with The Maintenance Co to regroove the traction sheave. Regrooving was necessary to prevent the new ropes slipping and to have the correct groove shape for them. Running new ropes in badly worn sheave grooves may reduce their life 50 to 75%.

Removing Sheave

The sheave could not be regrooved in place without a lot of special equipment, so the company did the job in its shop where all facilities are available for such work. We prepared to remove the sheave by landing the counterweights on timbers in the pit. We then anchored the ropes on the counterweight side in a clamp on the overhead structure. This clamp retained all slack in the ropes when the car was lifted by two chain falls. After the car had been lifted far enough to give sufficient slack we slipped the ropes off the sheave onto the floor where they remained until we installed the new ones.

It is quite a job to remove and replace an 1800-lb sheave under the conditions in many elevator rooms. There was no I-beam overhead to lift the sheave so The Maintenance Co's mechanics brought a portable lifting beam, Fig. 2, of light 4-in. steel channels and a 4-in. pipe, readily adapted to almost any job. Two bolts hold the two parts of each channel column together, and several holes permit adjusting column height to the job. Each column is notched for the pipe lifting beam, which is held from moving endwise by two

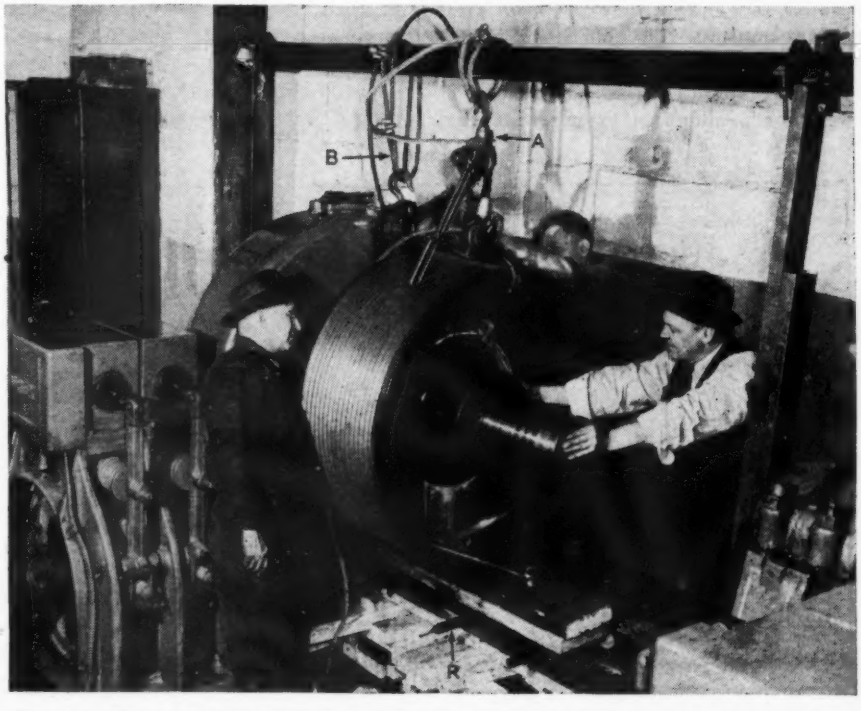


Fig. 1—Sheave being installed after regrooving. It was moved into position while resting on planks and pipe rollers and supported by the chain fall

clamps, one on each side of the column, Fig. 1 and 2.

The sheave shaft is supported in two bearings only, one on the outside of the gear case and the other, a pedestal bearing, outside the sheave. To remove the pedestal bearing the weight of the sheave was taken on two jacks under two heavy planks placed crosswise under the sheave.

Installed Lifting Beam

When the bearing was pushed out of the way they installed the lifting beam, as in Fig. 1, and took the weight of the sheave with a chain fall and slings, as at *A*. This permitted removing the jacks preparatory to pulling off the sheave. Because it had to be carried endwise about 3 ft to clear the end of the shaft, blocking was placed under it so that four planks with 2-in. pipe rollers between them, as at *R*, could take the sheave's weight. It was lifted slightly with the chain fall and the planks blocked tightly against it so that the load could be taken on either planks or chain fall.

The sheave's web is bolted to a hub keyed to the wormgear shaft. The mechanics removed the hub bolts and, with jack bolts in four tapped holes in the web, tried to jack the sheave off the hub. When the four bolts were tightened to a safe limit the sheave would not move. This made additional jacking power necessary.

They tapped four holes 90 deg apart in the sheave's web for pull bolts. To protect the journal they wrapped it in canvas and over this bolted two pieces of channel iron, one on each side of the journal, as at *C*, Fig. 3. These pieces were long enough to extend from the hub out beyond the end of the journal. Extending the channels beyond the end of the journal permitted the pull to be taken on the hub and not on the end of the journal. If the pull had been taken on the journal's end, there would have been danger of damaging it, as well as starting the hub from its seat on the shaft.

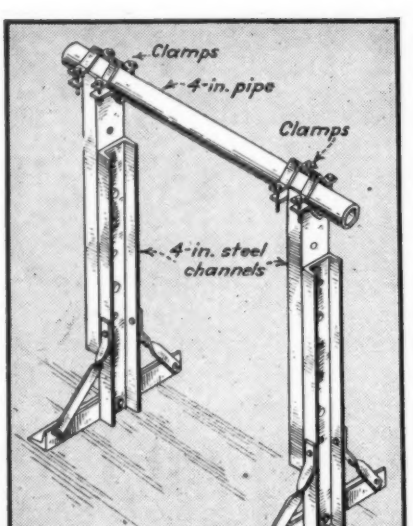


Fig. 2—Lifting beam made from 4-in.-diameter pipe and steel channels

Across the end of channel irons *C* they bolted two channels back to back with space between for two pull bolts, one in a tapped hole on each side of the shaft. When this channel pull bar was tightened in place a second one was placed at right angles across the first. This one connected to the other two pull bolts in the tapped holes in the sheave's web. By tightening the four pull bolts and four jack bolts the sheave was started off the spider.

Before removing the sheave the mechanics took a hitch around the shaft back of it. Then with a chain fall connected to a hitch on the lifting beam they took the shaft's weight, as at *B*, Fig. 1, to prevent putting bending loads on the gear case and its bearing. When the sheave was pulled off the spider shoulder, which required about 2-in. movement, the chain fall was slackened enough to transfer practically the entire load to the rollers. By working the sling along the lifting beam, the sheave was gradually rolled clear of the journal. While this was being done the chain fall served as a safety device.

Sheave Installation

Once the sheave was clear of the journal it was lifted by the chain fall and the blocking removed, after which it was lowered to the floor and taken to the shop. Handling the sheave during installation was largely a reversal of the operations during its removal. It was accurately centered around the hub and then pulled home with the holding bolts. Before doing this the hub shoulder was liberally smeared with white lead to make it as easy as possible to tighten the sheave on the spider and make the sheave easy to remove if it ever has to be taken off again.

After The Maintenance Co had installed the regrooved sheave we put the old ropes back on it, married the new ones to them, and ran the new on while running off the old. The elevator operated as satisfactorily as when new with no slippage of ropes in the sheave grooves. Fig. 4 shows the elevator machine after the job was completed.

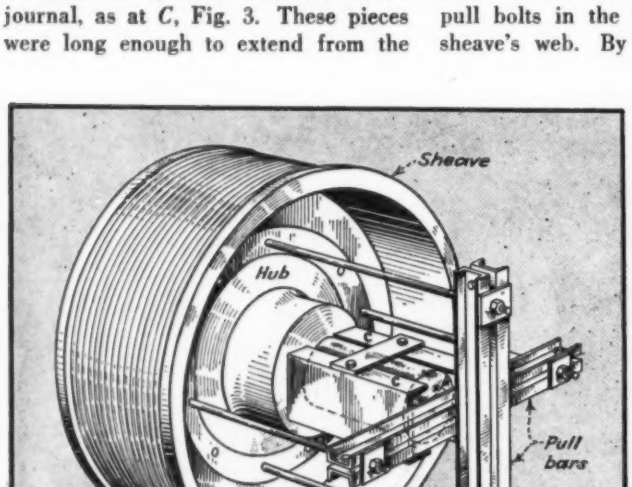


Fig. 3—To assist in pulling sheave off its hub, two pull bars made of 4-in. channels and pull rods were used

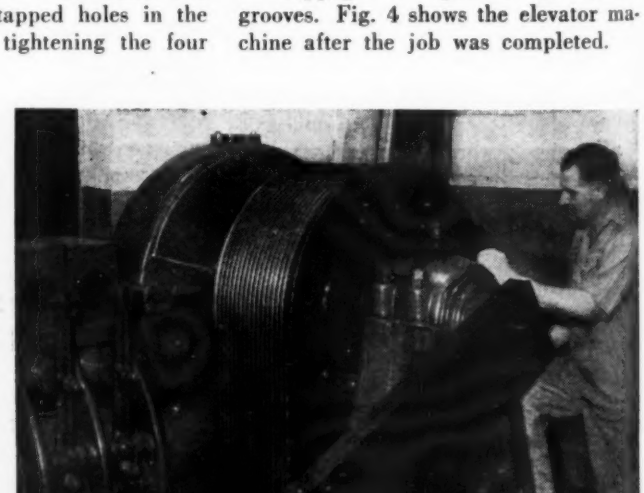


Fig. 4—Freight-elevator geared-traction machine after its regrooved sheave and new ropes had been installed

REFRIGERATION NOTEBOOK — 22

Capacity Controls for Refrigerating Machines

By TERRY MITCHELL, *ME, Frick Company*

THE NEED FOR CAPACITY controls on compressors is increasing rather rapidly because accurate temperature regulation is required for many industrial processes, as well as for air conditioning. Frequent stopping and starting is the simplest method of handling fluctuating loads, but this is open to many objections even in small systems, where it is otherwise satisfactory to have the cold either *all on* or *all off*.

Next simplest method of varying capacity is to change the compressor speed with a variable-speed motor, or to change the motor pulley diameter to suit the load or season.

Of the several other means of controlling capacity, the one most generally used today is to provide a port connected to the suction chamber in the side of each compressor cylinder, Fig. 1. This port is located so that compression does not start until it has been covered by the piston, which is usually at the middle of the stroke. When the valve placed at each port is open, the capacity of that cylinder is cut in half. When all the valves are closed, compressor operates at full capacity.

In a vertical single-acting inclosed-type compressor having two cylinders, such an arrangement allows the machine to operate at either 100, 75 or 50% capacity. If the machine has four cylinders, its capacity can be reduced in steps to 87½, 75, 62½ and 50%. By installing a hydraulic system, Fig. 2, and oil-operated pistons to open and close the valves, action of the bypasses can be made automatic. Oil pump is started by the same pressure- or temperature-operated controls that call for reduction in machine capacity. Although it is seldom done, the several bypass valves can be opened at intervals, one after another, by solenoid-operated valves on the oil lines.

A small Freon-12 unit handling, say, the air-conditioning load for operating rooms in a hospital must not be allowed to short cycle (on and off) in mild weather as the repeated starting and stopping would be objectionable, both because of the noise and the irregular cooling effect produced. The easiest way to prevent this is to bleed some of the discharge gas into the suction of the machine, when the suction pressure falls on very light loads. A pressure-operated expansion valve can be used for this purpose. Main objection to this method is that serious heating in the cylinders of the machine may result in damage.

Editor's note: This is Part 1 of an article that describes the different methods of regulating refrigerating compressor capacity to fit variable load conditions. The second and last part will appear in an early issue.

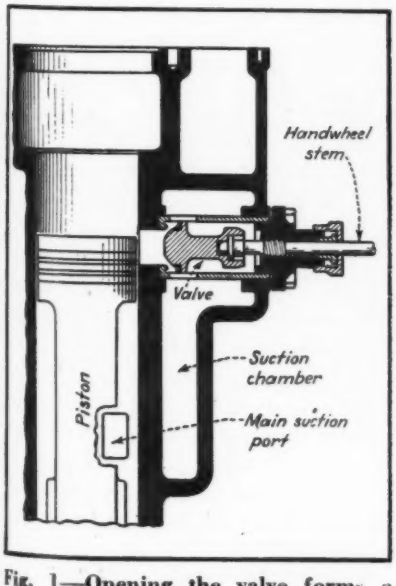


Fig. 1—Opening the valve forms a bypass from cylinder to suction

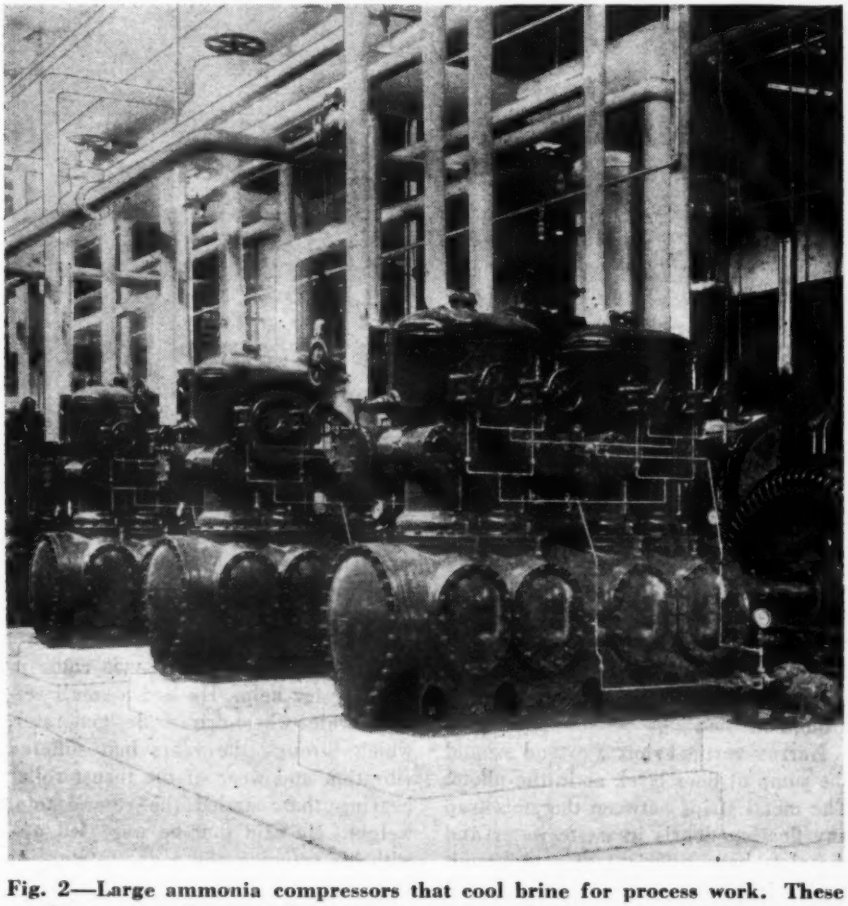
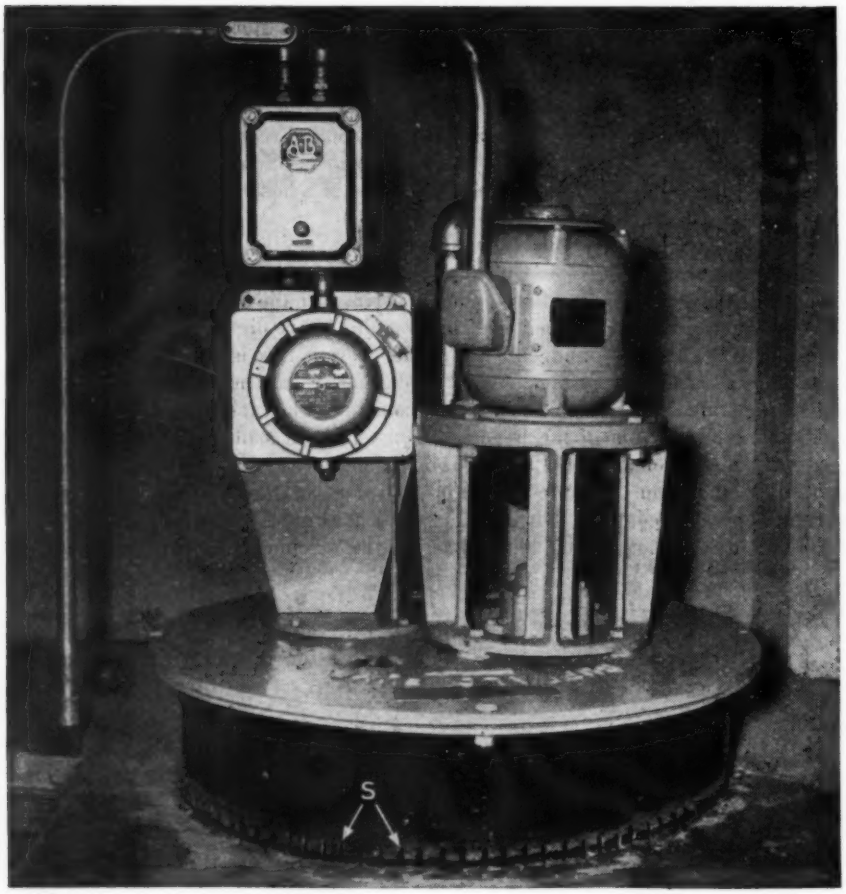


Fig. 2—Large ammonia compressors that cool brine for process work. These machines use oil-operated pistons to open and close the unloading valves

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



STRAINER AND DRAINER IN SUMP WALL

A COOLING-TOWER circulating-water-pump room being subjected to considerable flooding, particularly when pumps are overhauled, has a sump pump for handling large volumes of water at relatively low head. This pump is mounted on a circular steel plate bolted to the top end of a section of 30-in. pipe that forms the sump. The sump to catch all waste water is set in the ground with the pumphouse concrete floor poured around it.

Narrow vertical slots *S* extend around the sump at floor level, as in the photo. The metal strips between the slots trap any floating debris in waste water and the slots have sufficient area to permit rapid drainage. Before installing the sump it was painted inside and out with a hot tar enamel. Edges of the slots were also given a good coat to prevent rusting of the relatively thin metal.

Houston, Texas CHARLES C LYNDE

Split-Sleeve Coupling Covers Vibration Cause

ONE OF OUR GOOD CUSTOMERS came in one day for help. He had a small vertical water-wheel-driven dc generator, which through the years had suffered vibration and wear of the thrust roller bearing that carried the rotor's total weight. He said that he was "fed up" with his machine and a dozen, more or less, "experts" who had worked on it from time to time, without improving the operation. I gave him a first-class erecting engineer, whom he took along.

Next morning the engineer reported that he had fixed the outfit, which he had found out of line, and the generator was now running satisfactorily. A few days later the customer came in again and this is the tale he told.

"Your erecting engineer, as you know, is a man of few words, or even less than a few. He listened to my tale of woe and my many opinions as to the cause of the trouble, took a few measurements, got a piece of board and some paper, sharpened his pencil, cleaned his pipe, filled it and lit up. Then he got a piece of blocking, went out to a sunny spot beside the power house, sat on the blocking and enjoyed his smoke. Occasionally he would make a few marks on the paper. After this had gone on for half an hour or more, I started to phone you that I could sit in the sun and smoke, and it wouldn't cost me two dollars an hour. However, I realized that he would not be there if he didn't know.

Key Too Thick

"After a while he came to me and said, 'Let's take the split-sleeve coupling below the generator apart. One of the circular keys in the shaft and the sleeve coupling is too thick.'

"Sure enough, one half of the circular key was some twelve mils thicker than the other half. I remembered that we had dropped one half of the circular key in the flume during the original assembly, and the blacksmith had made and fitted another. Your man filed and scraped down the key to size, coupled up, and now I have a fine-running outfit.

"The oversized key kinked the shaft, and the split-sleeve coupling covered up and prevented any checking of the actual operating condition.

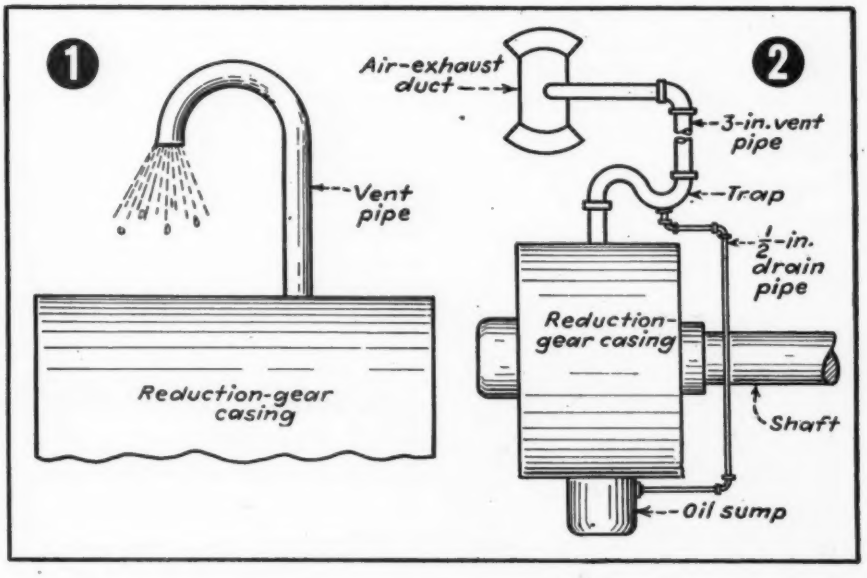
I, too, have had similar trouble with split-sleeve couplings and was discussing the problem with an old Scottish engineer, who said, "The only place to use a split-sleeve coupling is on a sawmill, and it should be a third-rate sawmill at that!"

Schenectady, N. Y. N L REA
GE Service Engineering Div

A Little Chemistry Identifies Valve Stems

WE INSTALLED some monel valve stems on a corrosive job. Several months later we discovered that we did not have a record of the valves in the group where the new stems were installed. To determine which valves in the group had monel stems we drilled the end of each stem. We put the drillings from each stem in a separate envelope and identified them as to the valve they came from. Our chemical laboratory easily identified the monel drillings after which we marked the valves according to the chemists findings.

Troy, N. Y. LEONARD W STIMSON



Changes in Vent Pipe Eliminate Oil Vapors

OUR TURBINE reduction-gear casing was vented as in Fig. 1. When the lubricating-oil temperature reached 140 F, excessive vapor and oil drops came out of the vent. A bucket placed to catch the oil was not satisfactory so we had to find another answer to the problem.

We solved the vapor problem by forming a trap in the vent pipe and extending the free end of this pipe to a convenient air exhauster, Fig. 2. The trap caught most of the oil coming up the vent. This we drained back to the oil sump by a connection to the trap as shown.

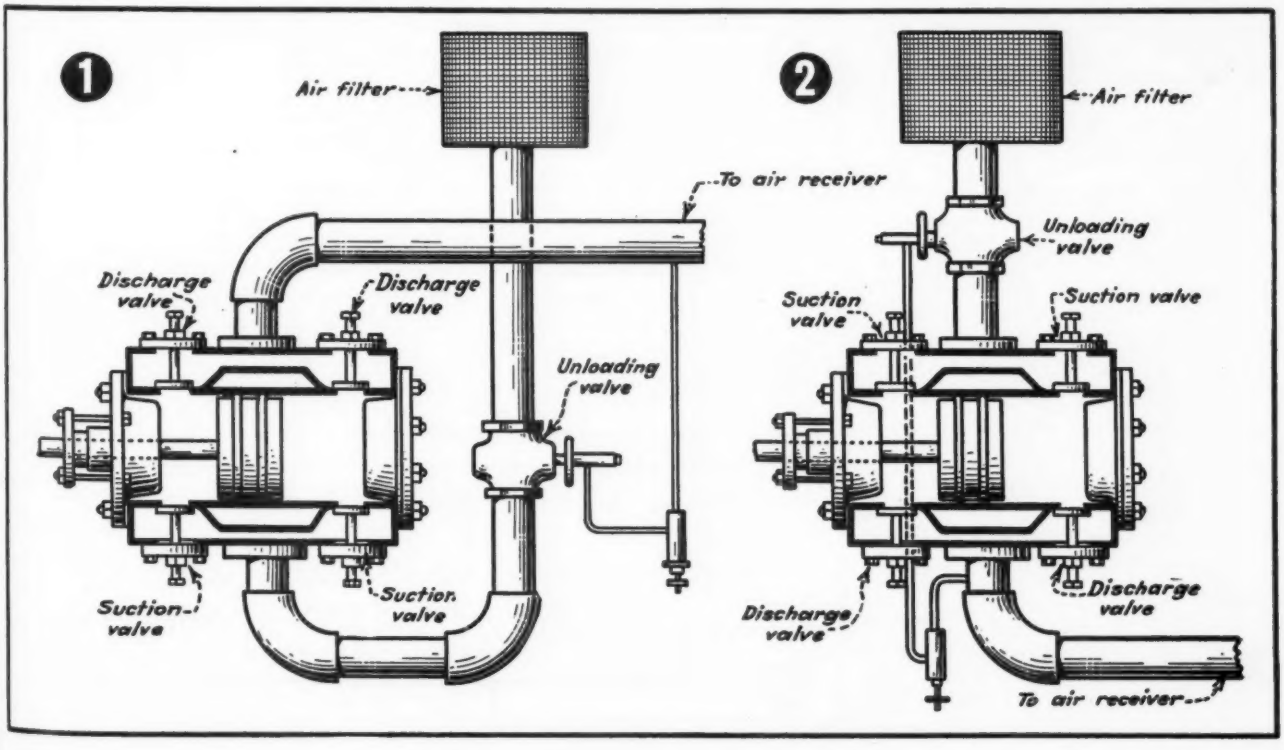
Great Neck, N. Y. S M ELONKA

VALVE CHANGES ELIMINATE WATER FROM CYLINDER

A CRACK in a single-stage air-compressor cylinder head permitted water to get into the cylinder. To make matters worse, the cylinder discharged at the top so that air did not sweep the water out; as a result, it accumulated and caused knocking at the end of each stroke. Until a new cylinder head could be obtained we decided to relieve this condition by changing the piping and valves so that the compressor would discharge at the cylinder bottom.

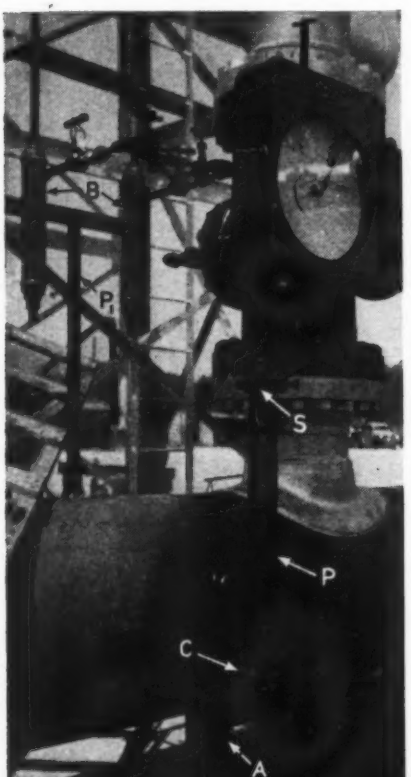
Fig. 1 shows the original piping. The job was simplified by the intake and discharge piping being the same size. We put the discharge valves in the cylinder bottom and the intake valve on top and changed the piping as in Fig. 2. To help take care of the water discharged from the cylinder we installed a drain pocket where the discharge line bends up to connect to the receiver.

We put a compound in the cylinder water jacket to help stop the leakage,



which was partly successful. After this the compressor operated successfully until we got a new cylinder head. Any water that leaked into the cylinder was swept out with the air and lodged either in the drain pocket or was carried into the receiver where it could be drained away to waste.

Ottawa, Ont. JOSEPH BONCIORNO



Rigid Mounting for Outdoor Flowmeter

A NATURAL-GAS PIPELINE COMPANY obtained accurate and rigid leveling of its outdoor-mounted flowmeters by the adjustable setting shown in the photo. Three pieces of pipe are cut and welded to form an inverted U, cast in a concrete foundation as at *A*. The U is so placed that its top section is paralleled with the pipeline and level.

One half of a flanged pipe coupling is clamped to the U at *C*. Bottom side of this flange curves to fit the pipe on which it rests and its top side is a ball socket into which the top half of the coupling fits. The vertical-pipe standard *P*, which supports the meter, screws into the top half of the coupling. The ball socket permits bringing standard *P* to a vertical position where it is securely clamped by the bolts in the coupling.

The meter support clamps to the standard top at *S*. This clamp can be adjusted vertically or rotated on standard *P* to permit close alignment of the meter with its connections.

On the lower ends of the connections from the metering orifice plate, sediment chambers *B* are clamped to a piece of angle iron and supported on a pipe standard P_1, threaded in a coupling welded to the main gas line. This arrangement substantially supports the sediment chambers and orifice piping.

Connections between flowmeter and orifice-plate sediment chambers are made with flexible tubing to isolate the meter from pipeline or structural vibration. Meter is supported free of everything except its base and may be accurately plumbed and leveled regardless of expansion or contraction or shifting of the pipeline.

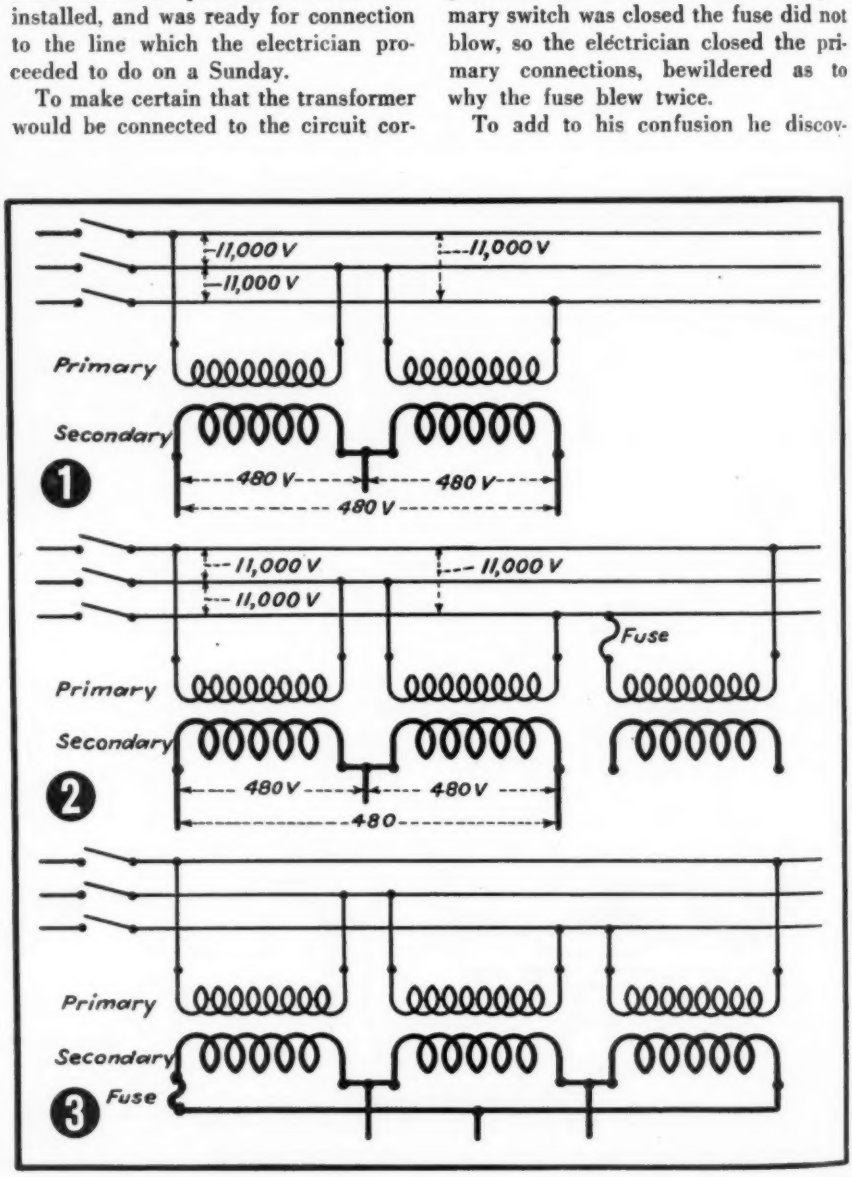
Houston, Texas CHARLES C LYNDE

BLOWING OF FUSES CONFUSES ELECTRICIAN

WHEN TRANSFORMERS are connected to the line the inrush magnetizing current can be quite high and may lead to erroneous conclusion, as in one plant. Here, power was supplied by two 250-kva, 11,000- to 480-v transformers connected open delta as in Fig. 1. These transformers became overloaded and a third unit was purchased. This was installed, and was ready for connection to the line which the electrician proceeded to do on a Sunday.

To make certain that the transformer would be connected to the circuit correctly the electrician connected a piece of 3-amp fuse wire in one of the primary connections, Fig. 2. When he closed the primary switch the fuse blew. After checking the connections and finding them okay he tried a second fuse with no better luck. He then called the electrical engineer to solve the problem, but this time when the primary switch was closed the fuse did not blow, so the electrician closed the primary connections, bewildered as to why the fuse blew twice.

To add to his confusion he discov-



ered that the primary ammeter on the two open-delta-connected transformers would read about 25 amp when the switch was closed and then drop to practically zero. When the third transformer was connected to the primary bus, but with the secondary open, the ammeter reading jumped to about 60 amp and returned to near zero.

The answer to all this is the inrush magnetizing current at the instant the primary switch contacts first touch. This current can be any amount from normal no-load to several times full-load value, depending on point on the voltage wave at which the circuit is closed and direction in which the transformer core is magnetized. If the transformer iron is magnetized in a direction corresponding to current flow when the switch closes and closure is made at zero on the voltage wave, magnetizing current will be normal. This happened to be the condition when the electrician tried the third fuse that did not blow.

When the transformer core is magnetized the same as current-flow when the switch closes and closure is made at the voltage-wave peak, inrush magnetizing current may be several times full-load value. Some such condition as this existed when the electrician closed the primary switch and the ammeter reading jumped to 60 amp, then dropped back nearly to zero.

When checking delta-to-delta-connected transformers, first complete the connections at all but one point in the delta on the secondary side. Then, complete this connection through a light fuse or a voltmeter, Fig. 3. If the connections are correct the fuse will not blow and a voltmeter will read zero. If the fuse blows or the voltmeter deflects, then the connections are not correct or the transformers do not all have the same polarity.

Chicago, Ill. J B MULLINS

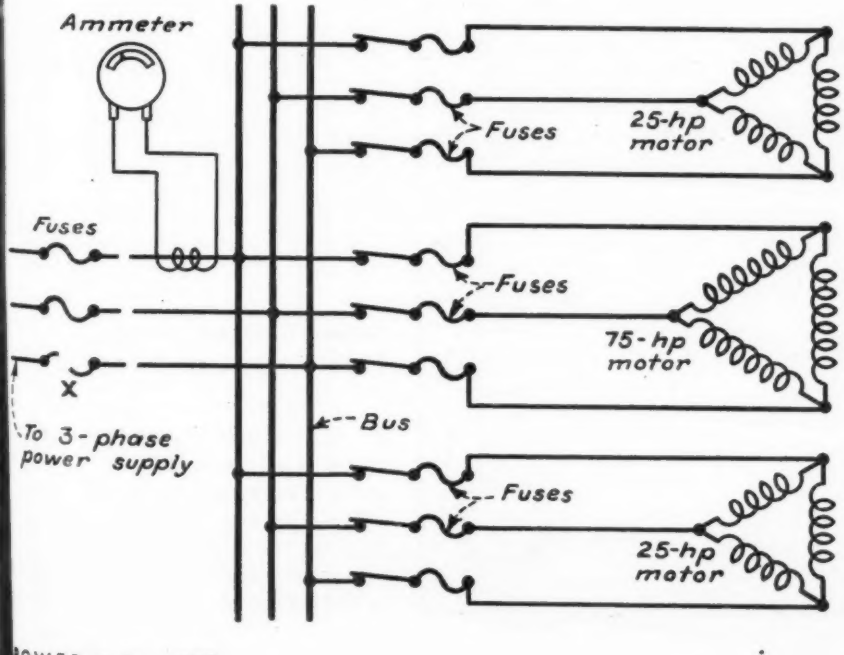
MOTORS ACT AS PHASE CONVERTERS

THE READING of an ammeter increased above normal on a group of three 3-phase induction motors. At first we thought that an overload was the cause, but all connected machines were found to be operating normally. We then tested for single-phase operation by shutting down one motor in the group. When we started it again, it came up to speed. This seemed to show that the motors were not operating single phase because the motor would not have started if one of its fuses had blown.

We then stopped the three motors in the group to check the machines they were driving. When this did not reveal anything that could cause an overload we tried starting the motors but none would start. This indicated an open phase. The three motors were grouped as in the diagram and a test of the fuses showed one blown in the main feeder as at *X*.

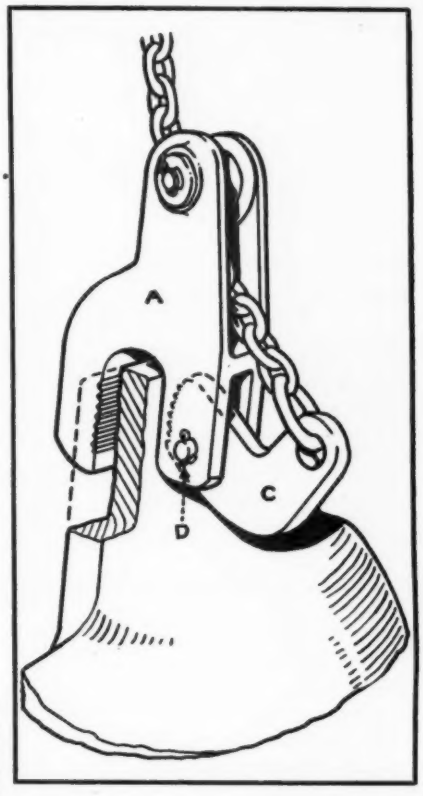
As long as one motor in the group was running it acted as a phase converter to maintain 3-phase voltage on the bus. Consequently when only one motor was shut down the others provided 3-phase voltage to start it. When all three motors were stopped, it left only one phase alive and the motors could not start. This experience indicates that single-phase operation may have some baffling effects. However, when the current suddenly increases on a group of induction motors it is a good indication that one phase has opened.

Detroit, Mich. L R CARRY



Lifting Clamp Takes Hold Automatically

A LIFTING CLAMP, devised in General Electric's Lynn River works for forgings, plate stock and other irregularly shaped pieces, makes possible faster and safer handling than the conventional chain-sling lifting method. Device is about 12x15¾ in., weighs about 50 lb and lifts up to 1000 lb. The clamp has an inverted Y-shape jaw *A*, one side of which is formed by a cam lever *C*, operated on a ⅞-in. drill rod *D* by a ⅜-in. lifting chain, as in the diagram. Teeth are cut into both jaws, and the beveled cam lever *C* automatically adjusts the clamp to accommodate objects with edge sizes from 2¼ to 3¼ in. Pieces being handled can be repeatedly jarred against other steel billets, and the clamp will retain its hold. As the tension is taken off the chain, the clamp automatically releases its hold.



READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions from Our Readers

1—Can Boiler Output Be Increased?

THE SHADED AREA in sketch Q-1 shows a section of breeching I would like to install to connect the two left-hand boilers with those on the right. I also expect to install a damper in the duct at right-hand stack.

Left-hand stack is 13x175 ft and its breeching connects to two 665-hp boilers. These units develop 1100 hp, each at 168% rating with a stack temperature (boiler outlet) of 500 F when burning 10,250-Btu raw screenings on grates and using natural draft.

Right-hand stack, 10x175 ft, now takes care of two sets of boilers, 2 150-hp hrt and 2 511-hp long-drum units. The 511-hp boilers have natural-draft chain grates and develop 1100 hp each. The 150-hp units have flat grates with Roto stokers and develop 200% rating each with forced blast.

Because the 665-hp boilers developed only 1100 hp, I investigated. The 511-hp units are 77% as large as the 665-hp units. Available draft at stack bases is 1.1 in. It is logical to assume that stack-area differences increase gas velocity in the 10-ft stack when burning the same amount of coal on all four units. The 665-hp units evaporate 7.73 lb and the 511-hp ones 7.25 lb per lb of coal. I feel this will equalize and that the 665-hp boiler output will increase when cross-connecting breeching is installed. I would like to have any suggestions on this problem that the readers of POWER may care to give me, in line with their experience.—*TEP*

2—Do Old Boilers Warrant Some Repair?

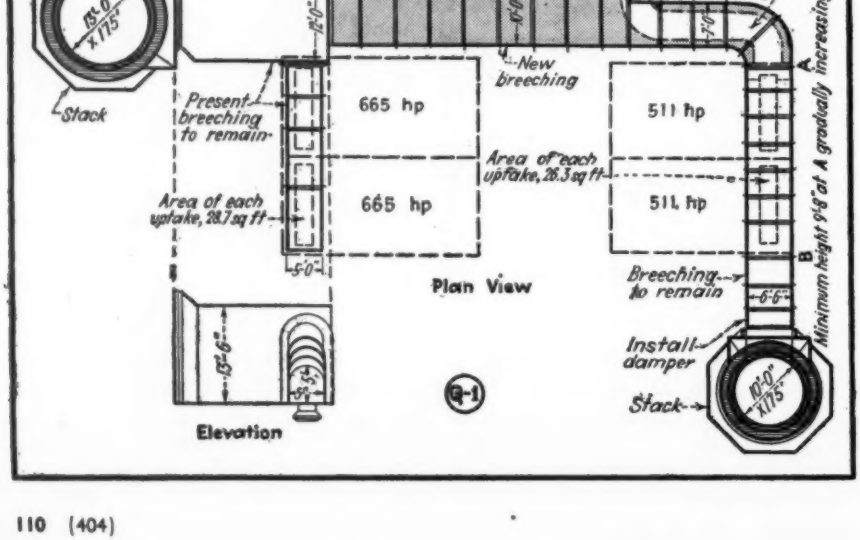
WE HAVE four 20-year-old boilers and one recently installed, 60,000 lb per hr, fired by a Roto stoker. Old boilers are fired by underfeed stokers.

I would like to replace two of the old boilers with a new 80,000-lb-per-hr unit. The old settings are in bad shape and so are the stokers. How can I show the management in dollars and cents that a new boiler will produce steam more economically than the old ones? I hesitate to invest money in the latter.

Repairing the old boilers by installing new stokers and adding water walls would be costly and we would still have old equipment. Is the life of a power boiler considered as 20 years? The new unit produces 9.5 lb steam per lb of 13,000-Btu coal. Old boilers give 7.6 lb, per lb coal.

I now believe that George Edwards had the right idea about salesmanship when he said that it is important for an engineer to be a salesman.

I will appreciate advice from other engineers who read POWER.—*HC*



Answers to April Questions

What Causes This Engine to Race?

(This is Question 1 from the April issue, with best answers from readers.)

We have a uniflow engine direct connected to a 500-amp 250-v dc generator, which is giving us considerable trouble.

When starting up and running without load, the engine races. If we open the cylinder drain valves, it comes back to normal speed. The same conditions

prevail when load is removed in preparation for shutting down; cylinder drains must be opened to hold engine speed at normal. Engine governor has just recently been overhauled and, as far as we can determine, is in good operating condition.

Any suggestions from POWER *readers as to the cause of this trouble and its cure will be deeply appreciated.—AF*

Repair Leaking Valves

ALL INDICATIONS POINT to leaking valves instead of governor defects. Governor may be functioning perfectly in controlling the valve timing, but its effect is being nullified by steam leaking past the valves when they are closed. Trouble is probably caused by uneven closing of the double-seated inlet valves.

Some poppet valves used in this type engine allow for steam-temperature fluctuations by having a spring-expanded valve which insures tight closing on both seats. However, this has no effect if seats and valves are badly scored and leaking.

The fact that the engine functions normally under load is further proof that steam is being supplied to the cylinder regardless of governor position. Remedy is to overhaul the steam and exhaust valves and insure their seating perfectly. Take a set of indicator cards under various load conditions before and after overhauling and compare these to check the results.

Kearny, N. J. GEORGE MCNALLY

Perhaps Governor Is Binding

RACING INDICATES steam leakage to cylinder. Investigate to determine the cause in the following order:

(1) Is governor action free and lubrication adequate? (2) Check governor setting. Valves should not open in short-travel position. (3) Does baked oil deposit between spindle guide head and steam bonnet hold valve open? Clean off if it does. (4) Do valves seat properly or are they badly worn? Perhaps the trouble lies in No. 3.

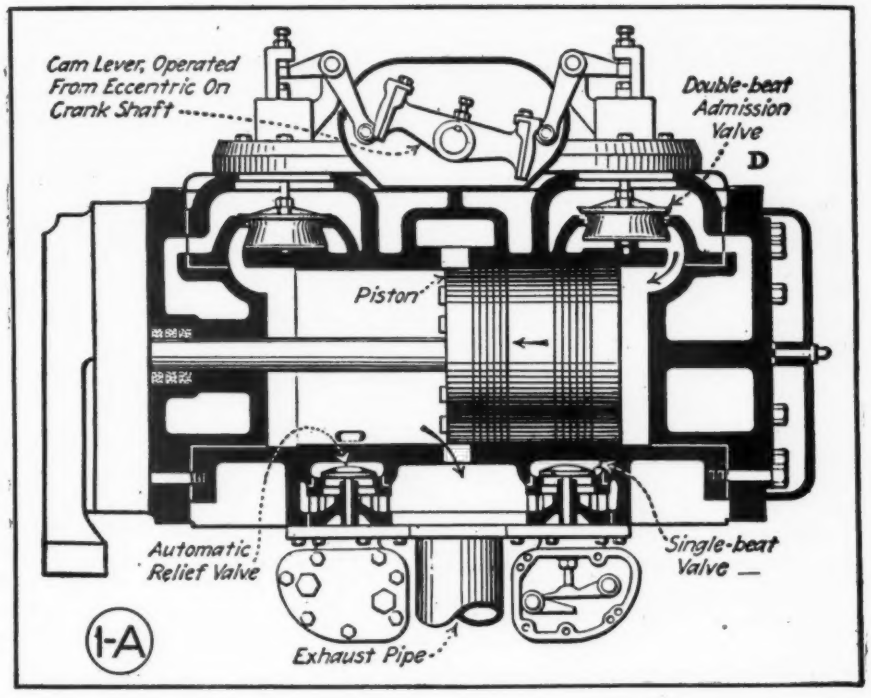
Cincinnati, Ohio W RIXMAN

Check Clearance Between Rollers and Cams

WHEN the uniflow engine eccentric is in position of minimum throw the valve-arm cams must not make contact with the valve-stem rollers at any point while the flywheel is turned through a full revolution. If they do, the governor will probably not control steam admission when the engine is running at no load, with the result that the speed may become excessive and the engine be wrecked. Therefore, it is well to be certain that the clearance between the valve cams and rollers at any part of the revolution is not less than 0.002 inch.

Exercise care when increasing the valve lead while the engine is carrying load. Do not increase it to such an extent that the governor loses control of engine speed when operating at no load. This condition may occur if the rollers are adjusted so far under the cams with the engine carrying load that, when the load is thrown off and the governor is on minimum travel, the rollers may still be contacting the cams and lifting the valves slightly. Steam would thus continue to be admitted to the cylinder. If this occurs it is only necessary to decrease the lead so that, with minimum steam pressure, the governor still controls the engine at no load.

Hamilton, Ont. S G PATERSON



Check Short-Travel Position of Governor

THE FACT THAT opening the cylinder drains brings the engine to normal speed indicates the valves are not closing in the short-travel position of the governor. Thus they admit more steam than necessary to overcome friction which causes the engine to overspeed.

To determine if this is true *AF* should clamp the governor in its extreme short-travel position (position governor should assume when all load is thrown off the engine). Then adjust the valves so that they just fail to open when the engine is turned over by hand. This insures the engine returning to normal speed when load is removed. It may be necessary to adjust the governor to the required speed and to equalize the valves with an indicator after this is done.

Watsontown, Pa. F C PLOTTS

Check Governor Linkage

RACING OF A UNIFLOW ENGINE when starting up, and again after removing load to shut it down, indicates that the governor does not move outward enough to prevent steam admission when correct speed has been attained.

Perhaps some part of the linkage between governor and valves is too long, and the governor cannot function properly. Evidently, the governor does not allow the admission valves to close, sketch 1-A.

Try this experiment: Block the governor to its extreme outer position, turn engine by hand, and watch for valve movement. There should be none.

ALBERT GASSMANN, SR.
Rochester, N. Y.

Use Weak Spring In the Indicator

THE FACT THAT engine idles too fast indicates that admission valves are either opening too far or remaining

open too long for no-load-speed operation. Further proof of this is shown when engine idles at proper speed after cylinder drain valves are opened and part of the steam escapes. Engine governor may be functioning properly but improper adjustment or wear in valve operating mechanism may be admitting too much steam.

I suggest that *AF* make careful inspection of the valve gear. If indicator is available take cards with a much weaker spring than is used for full load. This might show that only one valve is responsible for over-speed. It will at least serve as a check on adjustments or alterations.

Buffalo, N. Y. R E Fontaine

Valve Cages May Be Leaking

Since the governor has been overhauled, trouble may be caused by too much lead. Governor may lack control from no load to full load.

Set the valves without lead at no load, and yet so that they have sufficient for full load. To do this, block the governor at full-load position and set the valves so they just begin to open with engine crank placed in position as plainly marked on the engine flywheel.

Spring plate on inlet valve cages, which allows for expansion and contraction of valve cages, may be loose and leaking steam. Improper gasket thickness will alter valve operation if corrective adjustments are not made.

To give quiet operation, roller should clear cam between 0.003 and 0.004 in. when valve is closed. If clearance is not enough, engine may take steam for full stroke. Indicator cards will reveal this. *AF* should follow manufacturer's instructions and measurements.

G R Creighton

Port Dalhousie, Ont.

Measure Steam Rate

Assuming that proper adjustments have been made to the governor (it is one thing to overhaul a governor and another to make proper adjustments) there is only one thing that would cause racing. Too much steam is being admitted for the friction load.

I suggest a valve leakage test be run to see if the steam valves are seating properly. Do this by placing engine on center and opening cylinder drain valve. Be sure steam valves are unhooked so that valve will be on its seat. Then open the throttle; steam will blow out the drain if steam valve is not seating properly.

If *AF* knows the engine's normal steam rate he can take indicator cards and check the present rate. Leaking steam valves would show an increased rate.

Dunmore, Pa. E E Smith

Faulty Adjustment

Obviously this is the result of failure of a steam valve, or valves, to cut off steam to the cylinders when engine speed exceeds normal. This could be caused either by defective valve seats or by faulty adjustment of the steam-valve operating mechanism that does not permit the valves to close entirely.

That cylinder drain valves must be opened to bleed out sufficient steam to hold the engine speed to normal at no load indicates leakage is considerable. An indicator diagram of the offending cylinder, or cylinders, would show an abnormally high compression pressure.

The remedy is to locate the valves that are not seating tightly and correct the faulty condition that permits steam to pass continuously.

Seattle, Wash. J H Bender

Which Starting Method Is the Best?

(This is Question 2 from the April issue, with best answers from readers.)

We recently changed our factory over to purchased power and disposed of all generating equipment except one salient pole (without amortisseur winding) ac generator, with its direct-connected exciter and switch panel. Generator voltage is the same as the incoming power (2300 v).

Plans are being made to use this generator as a synchronous condenser to correct plant power factor. But to date we have not decided on the method of starting and paralleling it with the system.

Which is the better arrangement, a starting transformer to bring the unit to speed as an induction motor or a motor drive to accelerate it for paralleling as a generator? Also what changes must we make in the voltage regulator to adapt it for condenser operation? List other precautions.—CLF

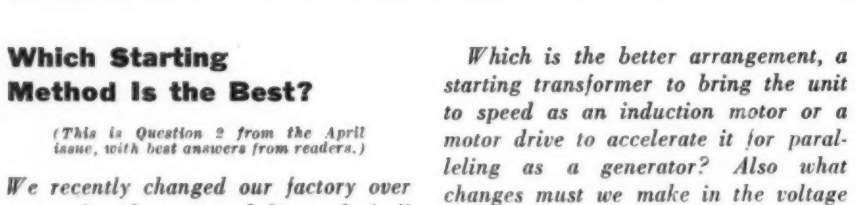
Make Use of Full-Voltage Starting

I suggest that *CLF* first investigate the possibility of installing amortisseur windings on his present machine. This eliminates the need for a separate motor to bring it up to speed and makes the control system much simpler. With a properly designed amortisseur winding the motor could be wired for across-the-line starting. This method works very well if a motor can be started under little or no load. We have a 700-hp synchronous motor, which is started across the line with a manually operated oil switch.

Since *CLF's* motor is for power factor correction it is likely to be operated at all times with a constant field—the maximum safe current. As the exciter is direct connected it can be wired permanently to the motor field, sketch 2-A. This greatly simplifies the controls necessary and automatically provides a time delay and gradual application of field current to the motor because of the inherent characteristics of the dc generator. It does not build up an appreciable voltage until up to full speed.

If it is not feasible to install amortisseur windings on the rotor I suggest that a small direct-connected induction motor be used for starting. Follow this procedure for starting:

(1) Bring motor up to speed with the auxiliary motor. (Have the synchronous condenser field windings short circuited through a resistor, the exciter field


2-A
A-C supply
Starter
Synchronous condenser
Exciter
Can be a hand-operated oil switch with overload protection trip as indicated
Direct connected to condenser shaft
Rheostat can be set in fixed position for maximum excitation

rheostat set for minimum output and the main ac switch open.)

(2) Close main switch to stator winding.

(3) Disconnect field from resistor and connect to exciter and gradually increase field excitation to desired value.

(4) Disconnect auxiliary starting motor from the line.

This method is more complicated and less satisfactory than when amortisseur windings are used. If not properly followed severe line disturbances can be created.

In order to operate efficiently as a synchronous condenser the machine should be equipped with a field winding that permits much greater excitation than is usual for a motor.

Elmira, N.Y. M H ELKIN

Suggests Trying One Of These Arrangements

ONE OF THE FOLLOWING METHODS may be selected by *CLF* as best suited to his specific requirements.

(1) Motor belted to generator shaft and left running, with power off, after generator is synchronized.

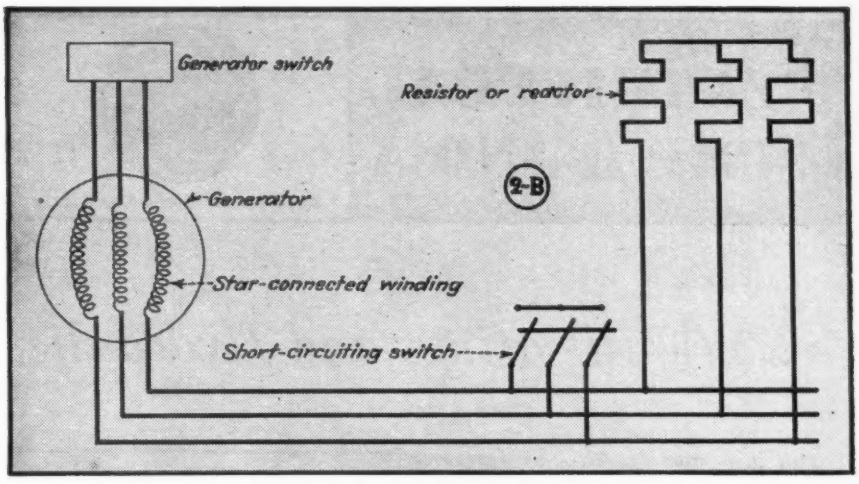
(2) Motor belted to countershaft and connected to generator shaft through coupling. After generator is synchronized open coupling and stop starting motor.

(3) Connect a reduced-voltage starting compensator in the circuit, add field-application relay and discharge resistor, and provide suitable time-delay relay to close field after compensator is thrown to running position.

(4) Remove present pole pieces, drill faces of each and install squirrel-cage winding. Add field-application relay and discharge resistor and install timing relay to close field at proper time.

(5) In event pole pieces (as in 4) cannot be drilled and cage winding installed, purchase from generator manufacturer a new set of pole pieces having the field coils and cage windings installed. If the manufacturer cannot supply new field poles, design new pole pieces, have them cast, drilled and fitted with a squirrel-cage winding and reinstall the old field coils. Equip with field-application relay, discharge resistor and timing relay for closing the field.

(6) If the generator winding is star connected, sketch 2-B, open the neutral, run leads to suitable compensator reactor, a set of resistances, or even an old 3-phase motor and install a short-circuiting switch to cut out the device and close the neutral after generator is thrown on the line. Also install field-application relay, discharge resistor and time relay.



Install an additional shunt field rheostat in series with present rheostat and adjust so that with regulator relay contacts closed, the generator will have maximum permissible current in its windings. This prevents overloading. If the generator will operate satisfactorily without a regulator on a fixed field current and armature current, set it for such operation.

In the event there is a large pulley or fly wheel on the generator shaft remove it to reduce the driving power required.

HAMMOND MATHEWS
Silverton, Colo.

Protect Against Low Voltage

WE HAVE two 300 kva 3-phase 60-cycle belt-driven three-bearing generators that we operate as synchronous condensers. For simple operation we belted 40-hp squirrel-cage induction motors to the generator pulleys to bring the generators up to speed. The motors are controlled by simple line start contactors and pushbuttons. After the generators are synchronized with oil circuit breakers and synchronizing lamps, the starting-motor contactors are opened and the motors run idle while the units are in service. We control the ampere load on the generators by hand and have found it necessary to adjust the load only once after starting.

To clear the generators from the switchboard in the event of line failure, we installed a voltage holding coil that controls a trigger device to open the circuit breaker of each machine.

In our case, we decided against using automatic voltage regulators as our machines are in distant locations from the power plant and normally operate unattended. However, if a regulator is used its mechanism should be set to limit the range of excitation to protect the generator in event of low line voltage.

Memphis, Tenn. C DEMERE

Guard Against High Induced Voltage

REDUCED VOLTAGE STARTING of a synchronous machine that has no amortisseur winding has its drawbacks. The unit must be started with an open field because it will probably fail to reach synchronous speed if started with a closed field. Open-field starting produces high voltage across the collector rings and subjects the entire field winding to a peak voltage that may reach 10,000. This can be reduced considerably by connecting a resistance across the collector rings. Resistance of the field rheostat is too low for this purpose.

The machine has, in all likelihood, seen many years of service and the windings and bracings may not be able to withstand the stresses imposed on them by this method of starting. Despite these undesirable features reduced-voltage starting is desirable because operation is simpler than when a separate starting motor is used.

The separate starting motor certainly eliminates the points mentioned above but brings in other difficulties. The machine is apparently a slow-speed unit. A direct-connected accelerating motor would have to be a special design, and as a result, expensive. This motor should have one or possibly two pairs of poles less than the main motor in order to accelerate it to or above synchronous speed. A belted line-start high-starting torque motor with proper

(*Continued on page* 140)

CENTRIFUGAL PUMP Q AND A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

4—*Bearings and Hydraulic Axial Thrust*

Fourth in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—What bearing designs are used on centrifugal pumps?

A—Practically every design has been used. Even the same basic pump design is often built with two or more bearing designs as service conditions or the purchaser requires. For double-suction single-stage general-service pumps, two external bearings, one on either side of the casing, are generally used. Formerly oil-lubricated sleeve bearings were used, but most pump manufacturers now use anti-friction bearings extensively that are either grease or oil lubricated.

Q 2—What is a self-aligning bearing?

A—It is made to adjust itself automatically to a change in shaft angular position. In babbitted bearings, the name applies to bearings in which the bearing shell has a spherical fit in the housing. In anti-friction bearings it applies to those with a spherically ground outer race, *R*, Fig. 1, to permit the bearing to align itself to the position of the shaft.

Q 3—What designs of anti-friction bearings are used?

A—Various ball-bearing designs are most commonly used. Roller bearings are used to a lesser degree but spherical-roller bearings, Fig. 7, are used quite extensively on large shafts for which the choice of ball bearings is limited.

Q 4—What types of ball bearings are used?

A—Commonest are single-row deep-groove, Fig. 2; double-row deep-groove, Fig. 3; double-row self-aligning, Fig. 1; and the angular contact type made in double- and single-row designs, Fig. 4 and 6. All except the double-row self-aligning bearings can take both axial thrust and radial loads. The ball thrust bearing, Fig. 8, was formerly used to take thrust only in combina-

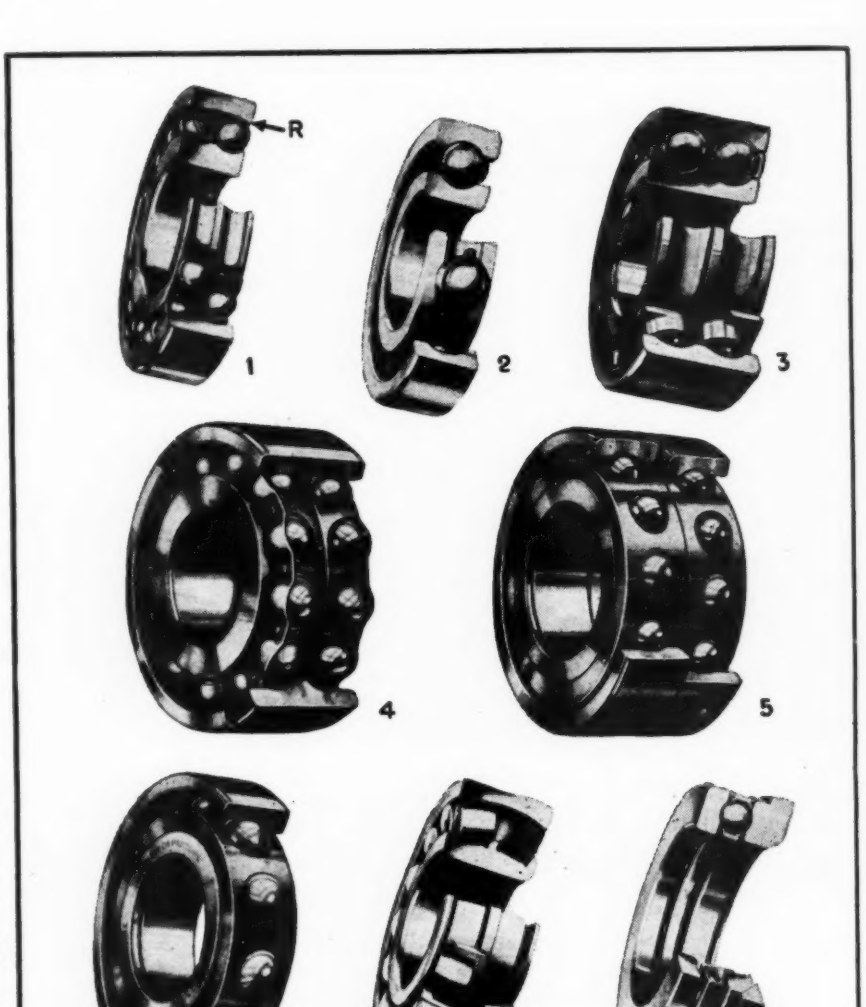


Fig. 1—Self-aligning double-row ball bearing. Fig. 2—Single-row deep-groove ball bearing. Fig. 3—Double-row deep-groove ball bearing. Fig. 4—Double-row angular-contact ball bearing takes axial thrust in both directions. Fig. 5—Two single-row angular-contact ball bearings back-to-back to act as a double-row bearing. Fig. 6—Single-row angular-contact ball bearing takes axial thrust in one direction. Fig. 7—Self-aligning spherical-roller bearing. Fig. 8—Ball thrust bearing used with sleeve bearings to take thrust

These things *some* factories knew before; these things the war *proved* beyond all doubt; these things *most* production men will never forget:

- A factory must always be able to convert its production facilities quickly and easily to utilize improved methods or to meet changing demands;
- It must reduce to a minimum the non-productive time of men and machines;
- It must fit equipment ever closer to the convenience and safety of workers;
- It must conserve floor space without creating congestion.

So, hundreds of progressive factories are buying or planning to buy UNITROL. For UNITROL, the better system of housing and installing motor control, is also the means of keeping motor control ready for the unpredictable shifts of the future. UNITROL reduces non-productive time in the inspection and servicing of motor control. UNITROL centralizes motor control so compactly that all control can be brought almost within arm's length of the serviceman. UNITROL "brings the work to the worker" . . . the elements are accessible, convenient, easy to change or replace. UNITROL makes it virtually impossible to overlook any control during routine inspection, promoting systematic, rapid, thorough attention. UNITROL, the factory-assembled, factory-wired motor control center that saves costly preparation and space, and is so easy to expand, contract and "convert," is one of the outstanding contributions to industrial progress and efficiency. Ask for the FREE book on UNITROL today. CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

CUTLER-HAMMER
UNITROL
C-H

PUMP Q&A

(*Continued from p* 114)

tion with babbitted bearings, but now is used rarely on centrifugal pumps. Sealed, adapter and other ball bearings are used in special applications.

Q 5—When are self-aligning ball bearings used?

A—For heavy loads, high speeds, long-bearing spans with no end thrust, they are well adapted for line bearings on centrifugal pumps. The double row of balls, Fig. 1, runs in fixed grooves in the inner or shaft race and the outer race is spherically ground; it therefore operates as a pivot to take slight vibration or shaft deflection. It has very little thrust capacity and is not used for combined radial and thrust loads in centrifugal pumps. With large shafts, the self-aligning spherical-roller design, Fig. 7, is used instead of self-aligning ball bearings, Fig. 1. Self-aligning spherical-roller bearings, can carry a combined radial and axial load having considerable thrust.

Q 6—When are deep-groove ball bearings used?

A—Single-row deep-groove ball bearings, Fig. 2, are applicable to many services. They can take both radial and thrust loads. For conservative speeds, light thrust loads and short spans, these bearings are satisfactory. Double-row deep-groove ball bearings, Fig. 3, are in effect two single-row bearings with greater capacity both for radial and thrust loads. They are used quite generally when loadings exceed single-row bearing ratings.

Q 7—When are angular-contact ball bearings used?

A—Single-row angular-contact ball bearings, Fig. 6, can be used only on centrifugal pumps when there will be a thrust at all times in one direction and are limited primarily to vertical pumps. The double-row bearing, Fig. 4, or its equivalent, a matched pair mounted back-to-back, Fig. 5, are satisfactory for thrust loads in either direction. Some pump manufacturers standardize on this double-row angular-contact bearing for combined radial and thrust bearings and also use it for many applications where the double-row deep-groove design can be used.

Q 8—What dictates a designer's choice of lubricant for a pump's bearings?

A—In laying out a line of centrifugal pumps, choice of lubricant for their bearings is dictated by application requirements, by cost considerations and sometimes by preferences of a group of purchasers that use a major portion of a line of a particular design. For example, almost all oil-refinery centrifugal pumps have oil-lubricated bearings because refinery engineers insist on this feature. On the other hand, in the marine field preference is for grease-lubricated bearings. For highly competitive lines of small pumps, cost is a main consideration and the lubricant is chosen to obtain the lowest cost depending on the bearing design and requirement for high reliability of the pump in service.

(*Continued on page* 118)

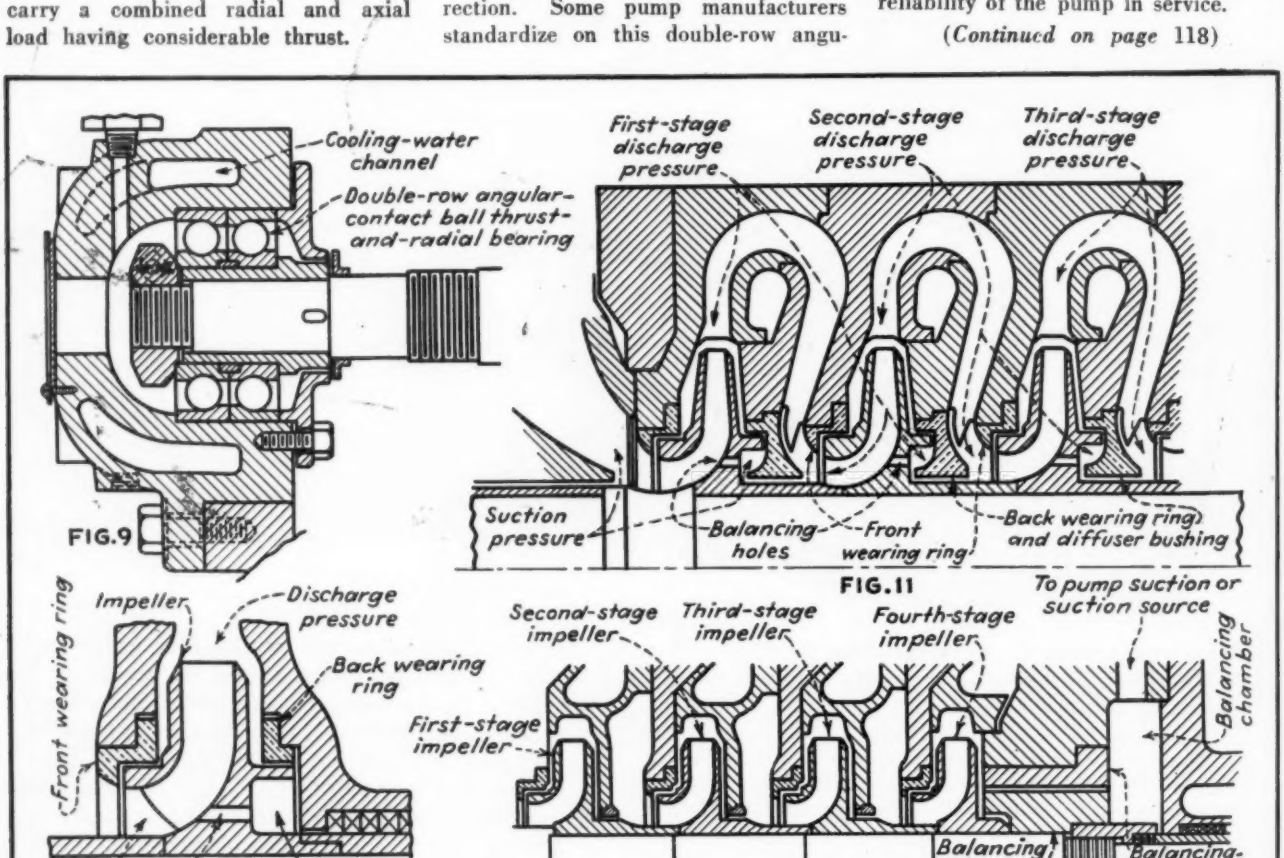
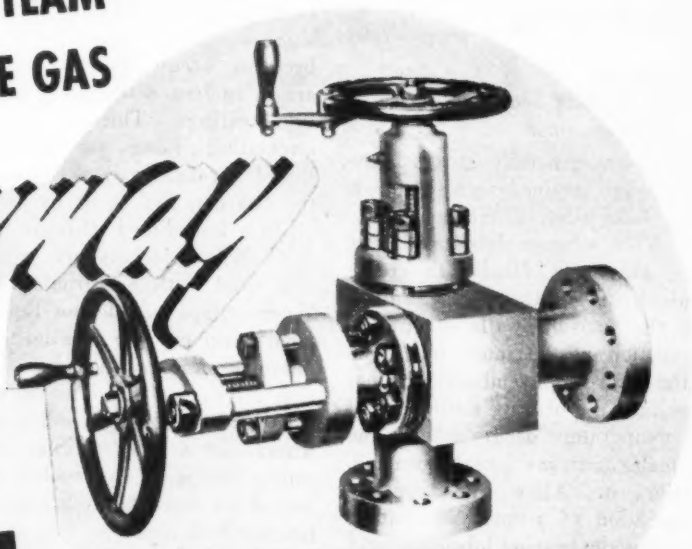


Fig. 9—Watercooled grease-lubricated double-row angular-contact ball bearing takes both axial thrust and radial load of centrifugal-pump impeller shaft. Fig. 10—Axial hydraulic thrust on this single-suction impeller is balanced by a wearing ring on its back and a hole between the suction eye and pressure-relief chamber. Fig. 11—Axial hydraulic thrust on this multi-stage pump is balanced on each impeller in the same way as in Fig. 10. Fig. 12—Unbalanced portion of axial hydraulic thrust in this pump is compensated for by balancing drum on impeller shaft

WHERE HIGH PRESSURE STEAM HELPS MAKE HIGH OCTANE GAS

It's Yarway



YARWAY UNIT-TANDEM VALVE — Flanged Type
(Installation below shows Socket-Welding Type)

UNIT TANDEMS!

When this great California aviation gasoline refinery went "on stream" recently, it was only natural that Yarway Unit Tandem Blow-Off Valves should be on the job at the giant boilers in the high pressure steam plant.

Unit Tandems—Yarway's finest Blow-Off Valves—have proved themselves unequalled in service throughout all industries on pressures from 400 to 2500 psi.

The Unit Tandem is a combination of the Yarway Hard-Seat Valve (next to boiler for blowing) and the famous Yarway Seatless Valve (for sealing)—both contained in a one-piece forged steel body. This rugged construction eliminates interconnecting flanges, bolts and gasket required in bolted tandem designs, making an extremely compact unit. Equally suited for blowing or draining and for sealing in highest pressure service.

Nearly 40 years of laboratory and field experience concentrated on blow-off valve requirements has made Yarway the Blow-Off Valve Headquarters for Industry. Write for Catalog B-432 for pressures up to 2500 psi, or Catalog B-424 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Phila. 18, Pa.

Ask about the new Yarway 30-minute color and sound motion picture, with Lowell Thomas speaking—available for group showings.

YARWAY BLOW-OFF VALVES

PUMP Q&A

(*Continued from p* 116)

Q 9—How are ball bearings lubricated in centrifugal pumps?

A—They are generally grease lubricated although in the larger size bearings, oil lubrication is frequently applied. When grease lubricated, the bearings are partly filled with grease after which the rotating balls throw it out on the housing walls creating a slight suction at the inner race. Because the grease is a semi-solid, it does not flow into the bearing until a small rise in temperature occurs when some grease melts and runs into the bearing, lubricating it. After this, continuous circulation of a small amount of grease keeps the bearing lubricated and cool with minimum attention.

Do not pack the housing of a grease-lubricated ball bearing full of grease as this prevents proper grease circulation in the bearing and its housing. A rough rule recommends filling the housing one third full. An excess of grease causes the bearing to heat and grease to flow out the seals.

Q 10—When and how should pump bearings be water cooled?

A—If the amount of heat generated in the bearings is too much to be dissipated by air cooling, water cooling becomes necessary. Thrust bearings are more frequently water cooled than line bearings. This can be done by circulating water or other cooling liquid through a jacket surrounding the bearing, Fig. 9, or by cooling the oil in a forced-feed oil-lubricated bearing. Water jackets are most generally used with anti-friction bearings. When pumps handle hot liquids, heat from them may be transmitted to the bearings and their housings by radiation and by conduction along the shaft, thus adding to the cooling problem. There are a few installations where pump bearings are cooled with air forced by fans through ducts in the bearing housings.

Q 11—What is an integral-bearing bracket and what are its advantages?

A—An integral-bearing bracket is one that is cast onto the pump casing. Since the bracket is bored and machined at the same time as the casing, correct alignment is assured. The bracket is usually designed so that it collects leakage from the stuffing box.

Q 12—What are pedestal bearings and when are they used for centrifugal pumps?

A—Pedestal bearings have their housing supported on a flat surface, generally a pad on a bedplate or a sole plate in the foundation. They are best suited for radial loads and were used quite extensively on earlier centrifugal pumps. They have been generally superseded by bracket bearings because of easier alignment and increased thrust loads resulting from higher-head application. Pedestal bearings are still used on centrifugal pumps to support a separate jackshaft or an extension of the impeller shaft on some belt-driven, and some large pumps.

Q 13—If a centrifugal pump is fitted with ball bearings, should its driver have ball bearings or can sleeve-bearings be used?

A—It is sometimes argued that both a centrifugal pump and its driver should have the same type of bearings.

(*Continued on page* 136)

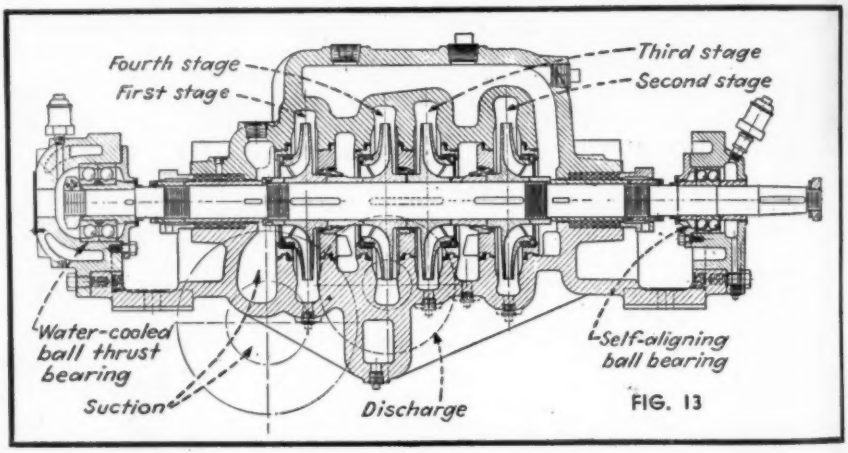


FIG. 13

Fig. 13—Four-stage pump with two of its single-suction impellers facing in one direction and two in the other to balance axial hydraulic thrust. Fig. 14—Axial thrust is balanced with this device by the leakage through the variable axial clearance between the balancing-disk head and balancing disk. Fig. 15—Combination balancing disk and drum take unbalanced axial thrust in high-pressure pumps.

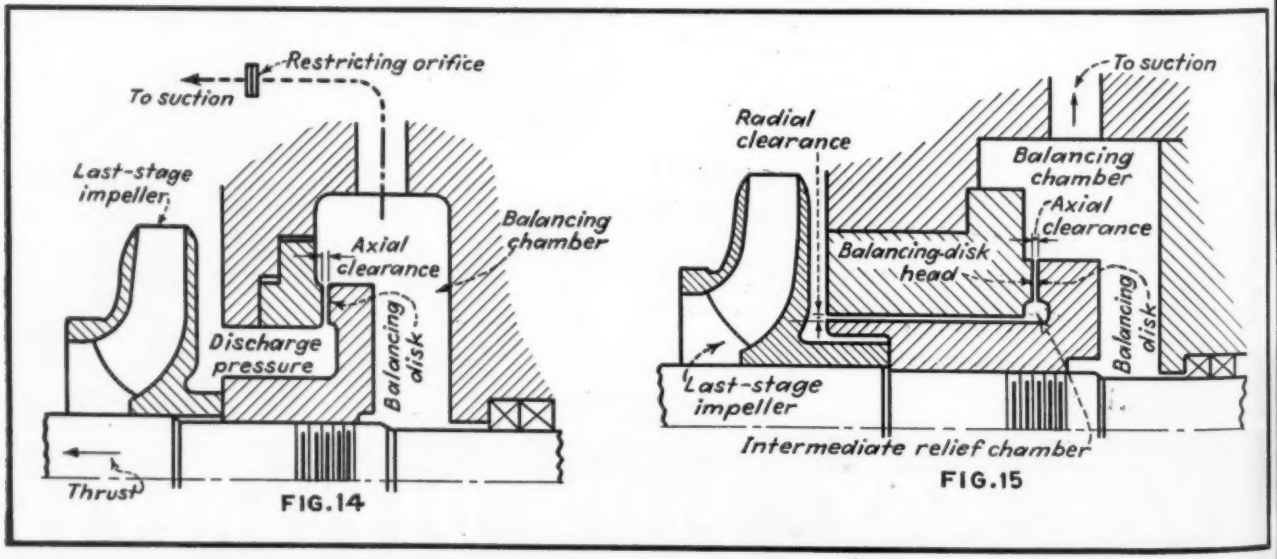


FIG. 14

FIG. 15

CARBON THAT WIPES AWAY

SUN DIESEL LUBRICANTS . . .

stop ring sticking . . . cut operating costs

Heavy carbon . . . gummy deposits . . . stuck rings in a diesel do not add up to efficient operation. And this trouble may often be traced directly to the lubricant.

Breaking rings to free them during the annual overhaul of a six cylinder diesel was the general practice of a large New England contractor. The lubricants he was using formed hard carbon and power-killing gummy deposits. Parts replacement costs ran high and overhauling became an expensive proposition.

Costs dropped after a Sun Oil Engineer suggested a change to a Sun Diesel Lubricant. No excessive carbon deposits were present at the next overhaul. The slight amount that did form was of a soft nature which was easily wiped away. All piston rings were free, including the top rings. Costs of lubrication and replacement parts dropped to a new low.

Engineering "Know How" of Sun Engineers and the proved quality of Sun Lubricants can do much to step up the operating efficiency of your diesels, gas engines, gasoline engines, steam turbines or electric motors. Sun service is yours to use for improved production, lower costs and more efficient operation. Write . . .

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO

SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

❶—Significant Figures

SOME THINGS TAUGHT IN SCHOOL should be unlearned at the first opportunity—for example "number of decimal places" as a measure of precision. For generations arithmetic teachers have been giving pupils the idea that the operations of arithmetic should be carried to some stated number of decimal places determined by custom or the teacher. The pupil generally ends up with the vague idea that 2 decimal places is rough, 3 decimal places fairly close and 4 decimal places quite accurate. All of which is pure bunk.

Decimal Nonsense

The best way to prove that these decimal place "standards" are nonsense is to test them out for extreme cases. See where we land if we assume that 4 decimal places is about right for any job of careful computation. Let's apply this notion to two numbers, 1000.00155 and 0.00105. Written to four decimal places, these become 1000.0016 and 0.0011. The error is 1 part in 20,000,000 for the first number and 1 part in 20 for the second number. Both figures are carried to 4 decimal places, but one is a million times as precise as the other.

Except in rare instances, the mere setting down of a number such as 1000.00155 in an engineering report marks its writer as a greenhorn with numbers. On the other hand writing 0.00105 as 0.0011 would often be inexcusably rough.

The first step toward practicality in applying arithmetic to real problems is to stop thinking "how many decimal places?" and start thinking in one of the three following measures of precision in numbers:

1—Precise to 1 part of———
2—Precise to ——— percent
3—Carry to——— *significant figures*

Thus, when an engineer is computing he should say to himself, "I shall put down enough digits so the error from omitting further digits will not exceed 1 part in———, or ——— percent, or I shall carry results to ——— *significant figures.*

Suppose a number is 10.05 and we write it 10.0. The resulting error is 5 parts in 1000, or 1 part in 200. It is also ½ percent.

With one exception to be explained later, the number of significant figures in any number as written is merely the total number of digits written down, *starting with the first digit that is not a cipher.* Thus:

Number	*Significant figures*
235.46	5
2.3546	5
0.0046	2
15.	2
35.0000	6
1.006	4

The only exception to this rule is where there are no digits (not even ciphers) after the decimal point, and where one or more digits immediately left of the decimal point are ciphers. Thus 23,400. might have either 3, 4 or 5 significant figures. However, 23,403. definitely has 5 significant figures and 23,400.0 definitely has 6 significant figures. More about this later.

For practice assume that the following quantities are to be abridged to various specified numbers of significant figures:

6253.462
4.86346
0.0943165
0.000443968

Then the abridged numbers are found to be as follows:

Significant figures	*Abridged number*
5	6253.5
	4.8635
	0.094317
	0.0044397
4	6254.
	4.864
	0.09432
	0.004440

Continuing to reduce the number of significant figures, we have:

Significant figures	*Abridged number*
3	6250.
	4.86
	0.943
	0.00444
2	6300.
	4.9
	0.94
	0.0044
1	6000.
	5.
	0.9
	0.004

From the foregoing we know that the number 6250 really has three significant figures, because the 0 does not represent the actual value of the fourth digit, but is merely inserted to make the number come out in thousands rather than in hundreds. A man who did not know the source of 6250 would say that it had at least three significant figures and possibly four (on the chance that 0 might happen to be the true value of the fourth digit.

In the same way one seeing the number 6000 without knowing its derivation, might take it to be a round number with one significant figure, but it could conceivably have 2, 3 or even 4 significant figures.

Powers of Ten

Mathematicians have their own way of making the situation clear in such cases. They might rewrite the numbers previously given as 6.2535×10^3, 6.254×10^3, 6.25×10^3, 6.2×10^3 and 6×10^3. Here 10^3 (ten to the third power) merely means that the decimal point is to be moved *three places to the right.* The four numbers are obviously carried to 4, 3, 2 and 1 significant figures.

Generally, an engineer will be dealing with his own computations and will know whether a 6300 he writes down actually means 6300 (4 significant figures) or is merely 6354 rounded to two significant figures.

Next month: More information about significant figures, so save this page for review.

PROOF that Edward streamlined flow cuts pressure loss, saves money

Here's evidence that pressure loss through your small globe valves can be greatly reduced, or that greater volume of flow can be had with the same pressure loss, by standardizing on Edward 60° stem forged steel globe valves.

See the result of Edward Valve streamlining in less turbulence, higher efficiency and maximum volume at the equipment where it's needed.

$$h = \frac{1}{K^2} \cdot \frac{w^2}{1891^2 D^4 \rho}$$

THIS formula for computing pressure drop is based on material presented in *Fluid Meters—Their Theory and Application.** Provided the value of K is known, pressure drop through any valve can be calculated accurately. K is a factor dependent upon the general shape and contour of the valve and is determined by experimentally measuring flow and pressure drop through the valve. If resistance to flow is low, K approximates 1; with high resistance to flow, K approaches 0. Values for K, shown below, for Edward Fig. 2688 type valve and typical ordinary forged steel globe valve were determined through experiments on Edward flow test lines.

*American Society of Mechanical Engineers, 1937.

h—pressure drop through valve, psi.

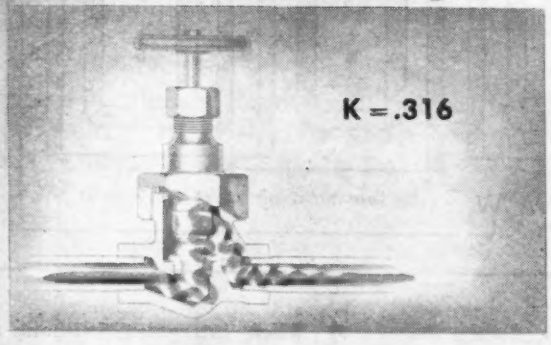
K—valve (or flow) coefficient.

w—weight of fluid through valve, lb/hr.

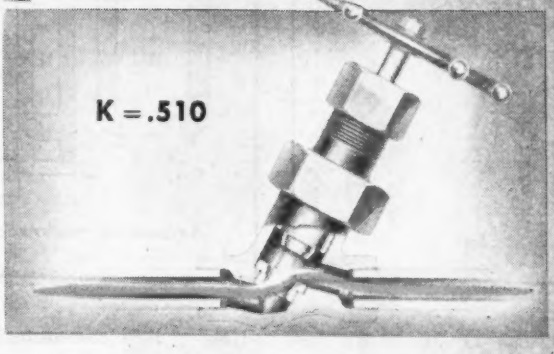
D—nominal pipe size.

ρ—density of flowing fluid, lb/cu. ft.

"X" VALVE



EDWARD 60° Stem VALVE



Steam . . . 10,000 lb/hr, 740 F, 525 psi, 2" line

$$h = \frac{1}{.316^2} \cdot \frac{10{,}000^2}{1891^2 \times 2^4 \times .797} =$$

h (pressure drop, psi) = 21.9

$$h = \frac{1}{.510^2} \cdot \frac{10{,}000^2}{1891^2 \times 2^4 \times .797} =$$

h (pressure drop, psi) = 8.44

Water . . . 50,000 lb/hr, 300 F, 900 psi, 2" line

$$h = \frac{1}{.316^2} \cdot \frac{50{,}000^2}{1891^2 \times 2^4 \times 57.4} =$$

h (pressure drop, psi) = 7.68

$$h = \frac{1}{.510^2} \cdot \frac{50{,}000^2}{1891^2 \times 2^4 \times 57.4} =$$

h (pressure drop, psi) = 2.94

Sharp turns in flow cause excessive turbulence (which promotes valve wear) and increase pressure drop (which wastes power). Edward 60° stem valves ease flow through with no sudden changes in direction.

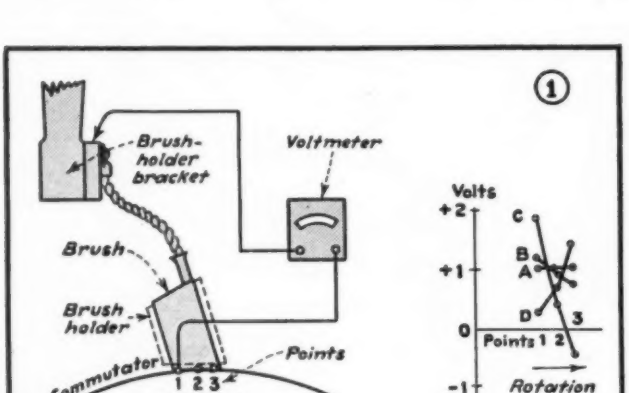
EDWARD *Steel* VALVES

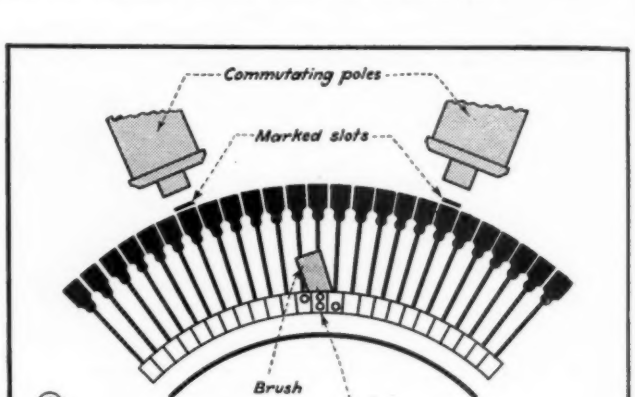
The Edward Valve & Manufacturing Co., Inc. • East Chicago, Indiana

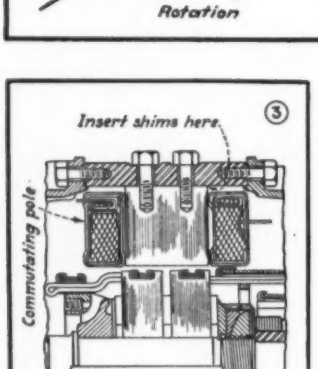
HOW TO TEST COMMUTATING FIELD ADJUSTMENT

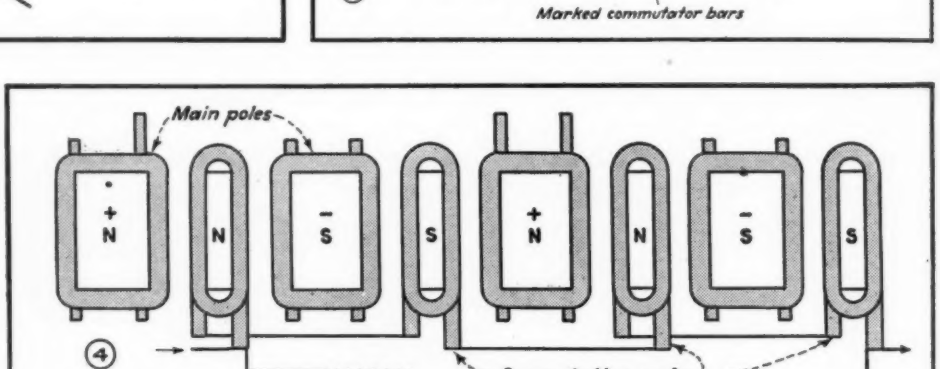
To PREVENT the neutral shifting during operation, dc generators have commutating poles between the main poles. They carry a low-resistance winding that connects in series with the armature so that the same current flows through both. But polarity of commutating-pole face opposes the armature's adjacent magnetic field.

Some dc machines operate with full commutating field while others use a resistance shunt across the winding to bypass part of the current. Adjust field strength in the former by changing the commutating-pole air gap or the turns per coil and in the latter by shunting more or less current through the resistor by changing its resistance.









1 Check commutating field adjustment by measuring the current distribution and voltage drop across different points of brush and commutator contact. Connect one terminal of a dc voltmeter, having a 5-volt scale, to the brush pigtail and hold a lead from other terminal to commutator. The voltage drop at any point is an indication of current density in the brush at that point, and the curve thus formed by all the points indicates roughly the current distribution across the brush face.

Uniform current distribution gives the horizontal curve *A*, an ideal condition for collecting maximum current from the commutator, but owing to several other controlling factors this condition is seldom realized. Usual curve obtained at normal load with best commutation is *B*, sloping downward slightly in the direction of rotation. On low-voltage machines having graphite brushes, curve may show sharper incline. A field that produces this kind of curve is correct.

If, on the other hand, curve slopes rapidly in direction of rotation *C*, perhaps crossing the zero line, commutating field is too strong; if it resembles *D* sloping upward with rotation, commutating field is too weak or reversed.

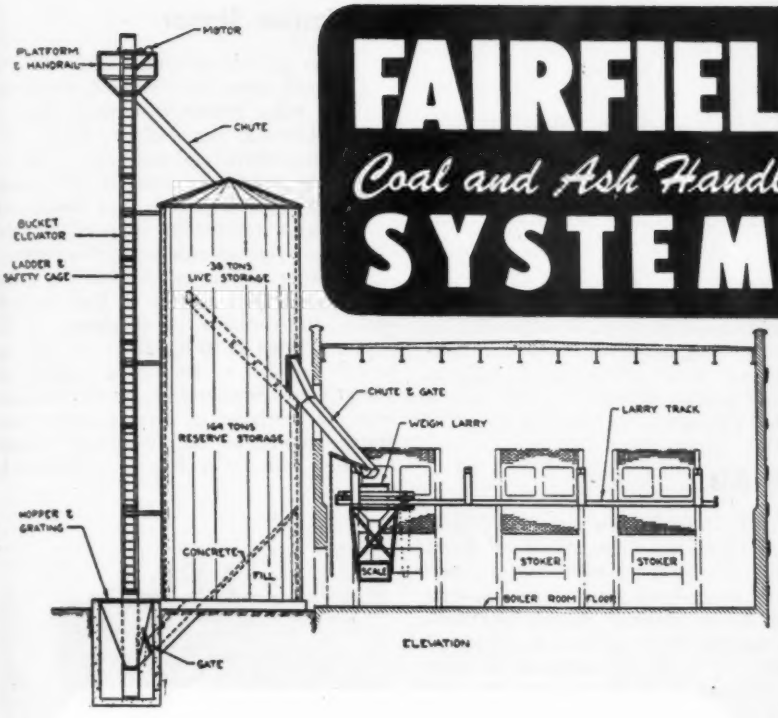
2 If the load neutral shifts ahead of the no-load point on a motor and behind on a generator the interpoles are too strong. Conversely if the load neutral shifts back on a motor and ahead on a generator interpoles are too weak and poor commutation results.

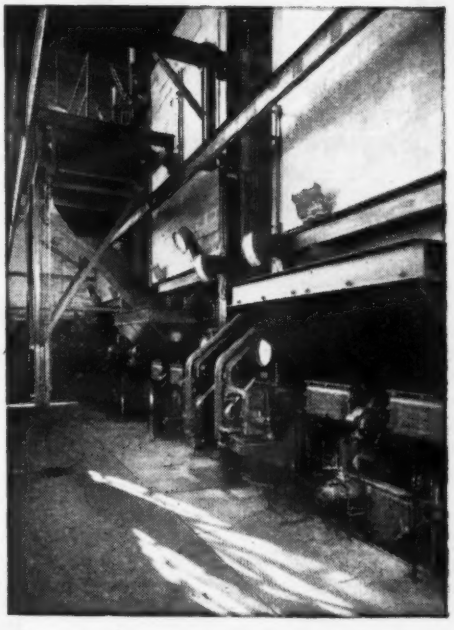
3 When interpoles (without shunt resistance) are too strong, adjust by removing shims from between each pole piece and frame to widen the armature air gap. If too weak add soft steel or iron shims to narrow the air gap.

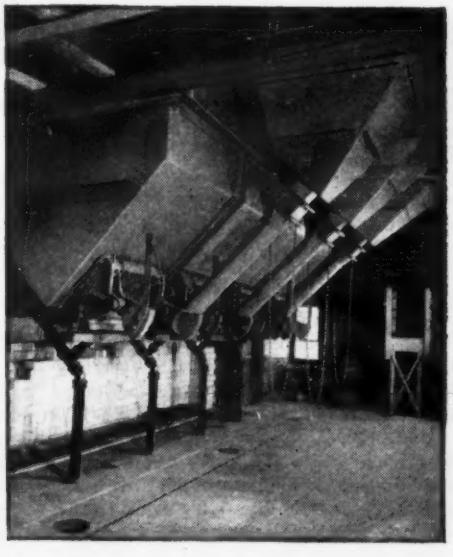
4 To increase interpole field strength adjust the shunt resistor (increase its resistance) so that more current passes through the winding. To weaken, cut out part of the resistance.

When good commutation cannot be obtained by adjusting the commutating field, check brush spacing and alignment, electrical connections, polarity of each pole, commutator surface, centering of commutating poles between main poles and the mechanical neutral position of the brushes.

FAIRFIELD
Coal and Ash Handling
SYSTEMS







• The Fairfield System of coal and ash handling illustrated is typical of the fully engineered method designed, built and erected by Fairfield to meet the individual conditions of your plant.

The vitrified tile silo for coal storage resists moisture—the air channels in the tile act as insulation against freezing in cold weather—locating the silo outside the boiler room eliminates dirt inside—the automatic handling of coal from car to storage to stoker or pulverizer makes for low cost.

Illustrated at the top right is a Fairfield Silo with bucket elevator—below this is a hand operated weigh larry for distributing coal to the stokers—at the bottom is shown ash hopper with gates for ash disposal.

If you are considering an addition to your present plant—conversion to coal—or erection of a new plant consult a Fairfield Engineer on coal and ash handling for ultimate economy and continued satisfactory service.

THE FAIRFIELD ENGINEERING CO.

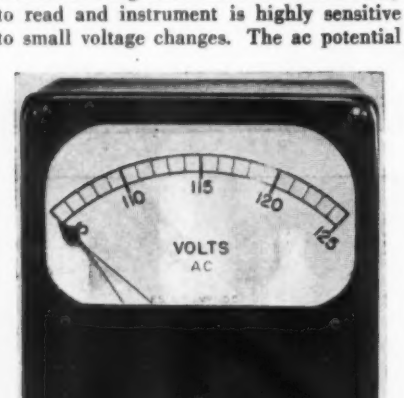
Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE • • • MARION, OHIO

What's New in Plant Equipment

Electronic Voltmeter

SMALL VOLTAGE BAND, such as 110 to 120 v, is magnified on voltmeter to cover full-scale range of a standard switchboard instrument. Magnified uniform scale is easy to read and instrument is highly sensitive to small voltage changes. The ac potential



to be measured is fed through an input transformer to an electronic rectifier. This potential is opposed by a constant dc potential maintained by an electronic stabilized circuit. Difference between input and stabilized potentials is supplied to the dc voltmeter.

Equipment consists of a standard dc voltmeter and a small steel box containing the auxiliary electronic devices. Auxiliary equipment, usually mounted on back of switchboard, may be used with more than one voltmeter. *Control Corp, 600 Stinson Blvd, Minneapolis 13, Minn.*

Open-End V-Belting

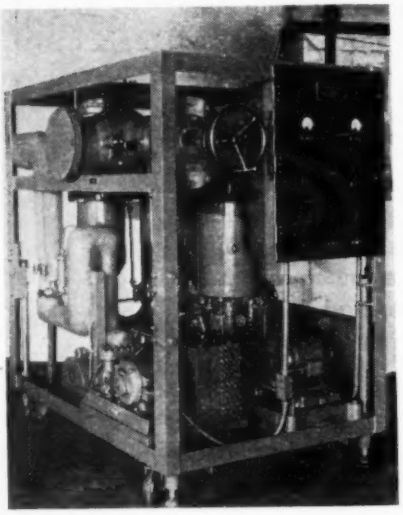
ANOTHER V-BELT, named *A* section, has been added to company line. Open-end V-belting is now in four standard sections of the same cross-sectional dimensions as endless V-belts, allowing use of standard sheaves. These sizes are the *A* with $\frac{13}{32}$ in. top width and $\frac{5}{16}$ in. thickness; *B* with $\frac{21}{32}$ in. top width and $\frac{7}{16}$ in. thickness; *C* with $\frac{7}{8}$ in. top width and $\frac{9}{16}$ in. thickness; and *D* with $1\frac{1}{4}$ in. top width and $\frac{3}{4}$ in. thickness.

Extension of the application of open-end V-belting has been made possible by a new fastener, named *Flex V*. This fastener can also be used on *B* section open-end V-belting and is simple and easy to apply.

Open-end V-belting helps insure efficiency and economy for many drives where application of endless V-belts is not practical. Line shafts and similar drives can be utilized with open-end V-belting and fasteners. Speeds of below 3000 ft per min are recommended for most efficient operation. The minimum recommended pulley diameters for the *A* section are 3 in., *B* section 5.4 in., *C* section 9 in., and *D* section 13 in. Belting is made by *B F Goodrich Co, Akron, Ohio* and fastener by *Flexible Steel Lacing Co, 4640 Lexington St, Chicago, Ill.*

Diesel Oils

CONFORMING TO USA SPECIFICATION 2-104B covering heavy-duty lubricants, *Vital* diesel oils, SAE 10 to 50 inclusive, are of detergent type embodying highly stable solvent-refined stocks, given a special treatment which renders them resistant to oxidation, formation of sludge or corrosion of bearings. Although specially treated, they are said to be competitively priced with other treated oils and with many straight mineral oils. *E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa.*



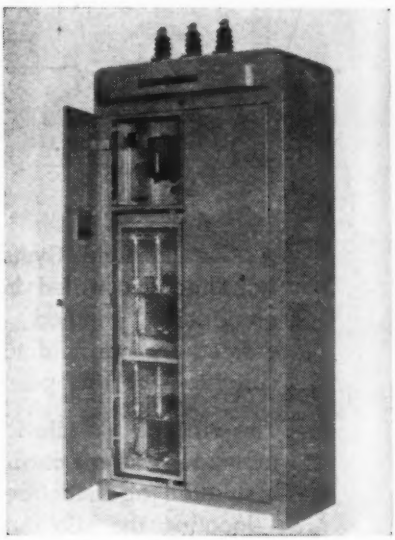
Pumping System

PS HIGH-VACUUM PUMPING SYSTEM, in a small compact unit for direct connection to system to be evacuated, is available in various capacities and ultimate vacuums. Unit consists of a mechanical forepump, diffusion pump, high-vacuum valves, gages and control panel. Mechanically refrigerated traps are built in on special order.

PS system is simple to operate and eliminates necessity of setting up high-vacuum pumping systems. One connection only is necessary. Unit is fully automatic and incorporates various safety and protective features. Vacuum conditions are indicated continuously on control panel and recorders may be used. Mounting is of rigid construction and may be put on casters for easy portability. *Vacuum Engrg Div, National Research Corp, Boston 15, Mass.*

Combination Starter

FOR DUSTY OR CORROSIVE atmospheres where short-circuit protection, without requiring fuses or other protective devices, is necessary, LZS-HR combination starter has 3-pole heavy-duty oil-immersed contactor, adjustable magnetic overload relays in each line of a 3-phase circuit, and disconnect switch with externally operated handle. Of high arc-rupturing capacity, this combination starter eliminates the fuse or other protective devices subject to high maintenance in corrosive atmospheres. LZS starter is rated at 50 hp, 220 v and 100 hp at 440 and 550 v. Rupturing capacity is 10,000 amp. Separately mounted pushbuttons are available to provide either low-voltage protection or low-voltage release. *Electric Controller & Mfg Co, Cleveland 4, Ohio.*

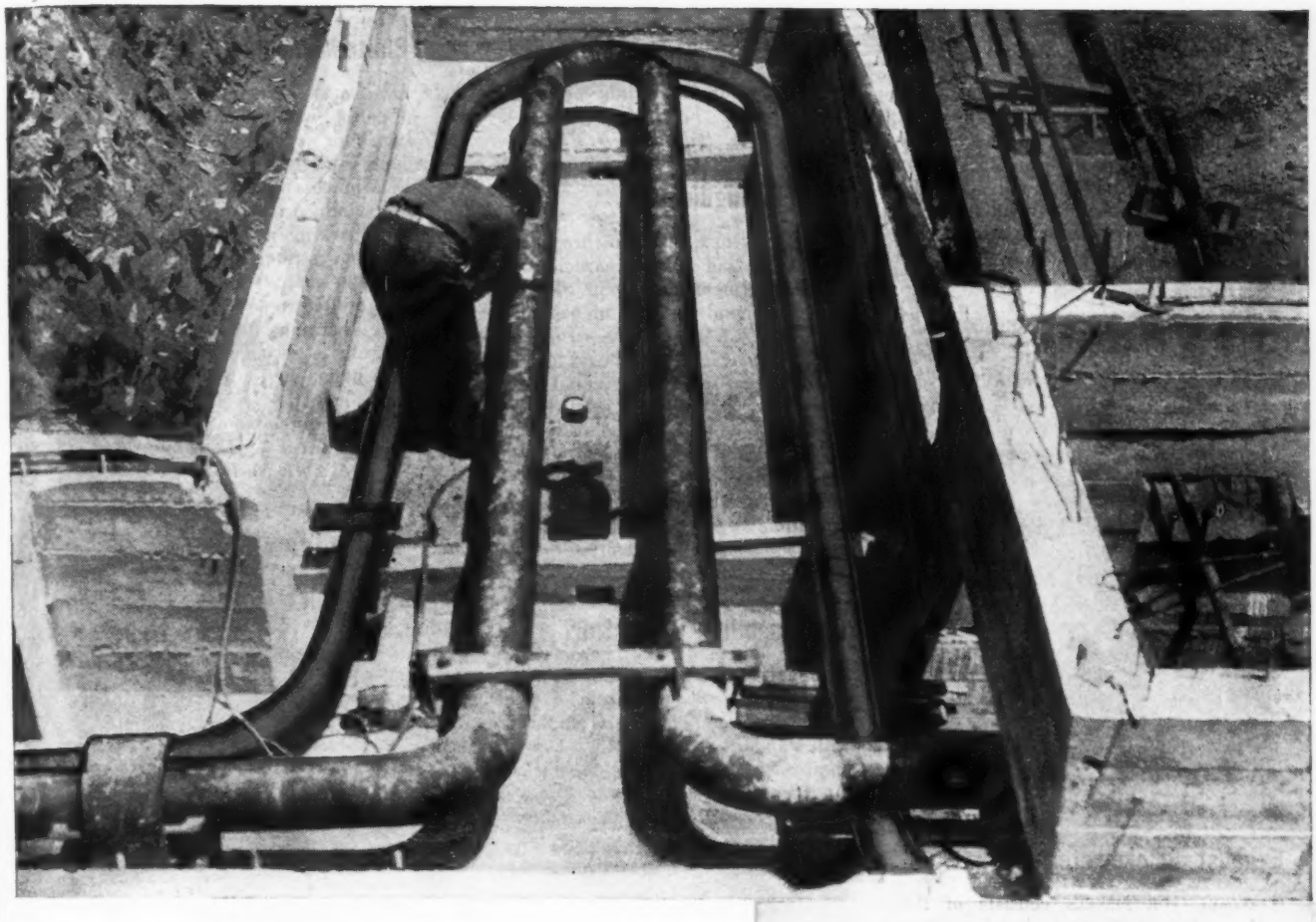


Auto-Switch Capacitors

METAL-INCLOSED self-contained auto-switch capacitor automatically switches 180 kva of capacitance on or off feeder in response to voltage requirements. Designed for improving power factor of distribution circuits at periods of peak load, capacitor is automatically connected in circuit when increased load causes a drop in voltage and is disconnected when voltage increases at light load.

Equipment consists of a 180-kva 2400-v delta or 4160-v 4-wire, 3-phase group of Pyranol capacitor units, a 3-pole solenoid-operated oil switch, automatic voltage control devices and a potential transformer for supplying control power, as well as control potential for voltage-responsive equipment. Although standard equipment is designed for response to line voltage, current-responsive equipment is also available.

Housing is designed for base- or cross-arm mounting. Cover bushings of wet-process porcelain with clamp-terminal connectors provide for easy connection to line. A hinged panel, containing all devices for both automatic and manual control, is mounted in a protective compartment which separates control from power circuits. A protective screen prevents accidental con-



The Trend Toward Permanence

EMPHASIZES THE ECONOMY OF LONG-LIFE MATERIALS

Illustration shows expansion joint for heating lines laid in 8,800 feet of concrete conduit at the University of Connecticut, Storrs, Conn. Condensate return lines, subject to the corrosive action of the boiler water, are of Anaconda Red Brass Pipe welded with Tobin Bronze*. Sixty thousand pounds of Red Brass Pipe, from 1½" to 6" S.P.S., were furnished by Crane Co., New Haven, who made the bends for the expansion loops.

Consulting architects and engineers to the State of Connecticut, Westcott and Mapes, Inc., New Haven. Contractor, C. N. Flagg & Co., Inc., Meriden. All welded joints were supervised and approved by Hartford Steam Boiler Inspection and Insurance Company. *Reg. U. S. Pat. Off.

MORE AND MORE, civic and industrial planning inclines toward the long range viewpoint. Permanent construction—using quality materials—gains in favor over the practice of building for immediate needs only. This type of planning emphasizes the economy of using long-life Anaconda Copper Tubes and Red Brass Pipe to resist corrosive conditions in air conditioning, heating, plumbing and industrial piping installations.

Experience over the past few decades stresses the dependability and durability of copper and brass in these applications. The extension of chemical treatment of domestic waters further increases the need for these non-rust materials.

Anaconda Copper Tubes and Red Brass Pipe are furnished in a standard range of sizes and wall thicknesses and allow the architect or engineer a choice of threaded fittings, solder-type connections or welded assemblies. 4571

ANACONDA
from mine to consumer

Buy War Bonds
Buy more
... HOLD ALL

Anaconda Copper & Brass

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: Anaconda American Brass Ltd., *New Toronto, Ont.*

EQUIPMENT *Continued*

tact with live bus while working on this panel. An electric interlock automatically disconnects equipment from line when protective screen is opened for access to capacitor units or fuses. A red signal lamp remains lighted while oil switch is closed and capacitors are connected to line. *General Electric Co, Schenectady 5, N. Y.*

Exhaust Smokemeter

HAZEGAGE FOR DIESELS consists of three parts: a light unit, photoelectric unit and an indicator that has a scale and two different-colored lamps. In operation the light unit, equipped with a standard electric bulb, shoots a path of light through the exhaust haze; the photoelectric unit measures the haze density in the path of light and shows it on the indicator scale. Whenever combustion varies so that haze is either too thick or too thin, the lamps light —green for too thin and red for too thick a haze. The pointer on the scale, set to zero to show optimum haze, moves to left for too thin or to right for too thick a haze. As fuel-air ratio is corrected, lamps go out and pointer goes back to zero on scale, indicating optimum engine efficiency.

If desired, sound alarms can be supplied with each gage, or if records are required, recorder-equipped *Hazegages* are available to keep a 24-hr record of performance of one or a battery of diesels. *Hazegages* are easy to hook up. Only required attachment is a sampling tube connected to exhaust outlet. Photo shows the indicator unit. *Ess Instrument Co, Ft Lee, N. J.*

Diaphragm Relief Valve

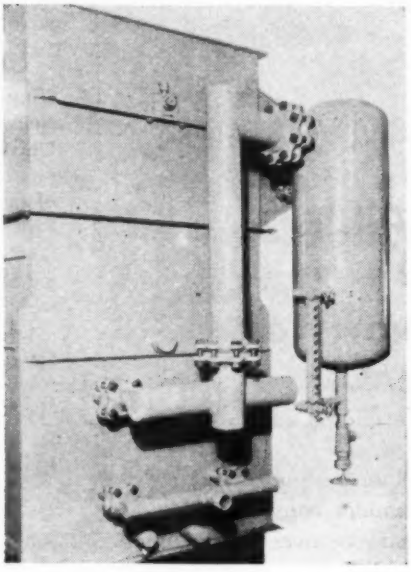
TYPE 1000 FARRIS RELIEF VALVE has a diaphragm which acts in several capacities. Diaphragm seals this valve from leakage encountered around stem in conventional design. Therefore, it is highly acceptable for relief service where there is fluid constantly on downstream side. Valve opens to full relieving capacity at 20% overpressure as a result of pressure on diaphragm. Valve closes at the set pressure. There is no "weeping" or pressure loss because of valve bleeding down below set point. These features make this valve particularly applicable for controlling pressure at relieving point. *Farris Engrg Co, 345 Commercial Ave, Palisades, N. J.*

Fire Extinguisher

ALFITE SPEEDEX, made in three sizes, Models 15, 10 and 4, uses carbon dioxide as the fire extinguishing agent. The numbers indicate pound capacity of gas. This unit is engineered to speedily extinguish small oil or electrical fires, with no loss of extinguishing gas on anything but fire itself. Operating valve lever is directly above carrying handle. It can be opened instantly by pressure of hand grip and closed by releasing hand pressure while operator is maneuvering his position. For continuous operation, D-yoke ring is slipped over operating lever while it is depressed. *American-LaFrance-Foamite Corp, Elmira, N. Y.*

Hardenability Calculator

CIRCULAR SLIDE RULE computes approximate hardenability of steel from its chemical composition and grain size in accordance with standard formulae. Free copy may be obtained by writing direct on your company letterhead. *Steel & Tube Div, Timken Roller Bearing Co, Canton 6, Ohio.*



Oil Separator

NEW METHOD of removing oil from refrigerant gas is offered as part of Niagara *Duopass* aero condenser. The new apparatus, called the Niagara *Oilout*, has a cylindrical drum located at outlet of *Duopass* coil so that the refrigerant gas enters with a tangential motion. More oil is removed by this method because the *Duopass* coil has reduced the temperature of the gas so that the oil vapor has been condensed. Expansion of the system from a 4-in. pipe to a 14-in. drum (in model shown) reduces velocity of the gas. Oil is easily removed and held by wall and separator plates of the trap. A sight gage and valve drain the oil. *Niagara Blower Co, 6 E 45th St, New York 17, N. Y.*

Plaited Packing

LONG-FIBER ASBESTOS YARN is used instead of cotton, with the advantage that the packing is for hot as well as cold water. Lubricant is *Palmetto* graphite grease, applied by a process which thoroughly impregnates every individual fiber of packing. As a result, packing is protected from water-logging and disintegration, according to maker, and its service life is greatly prolonged. It is plaited in square form and made in a wide size range. Equipment for which this packing is recommended includes centrifugal pump shafts, reciprocating pump rods and plungers, valves, fire hydrants and other apparatus handling hot or cold water. *Greene, Tweed & Co., Bronx Blvd at 238th St,, New York 66, N. Y.*

Electronic Motor Controls

VARITRONIC UNIT shown is a 25-hp model, for driving a dc motor from a 3-phase ac line and for obtaining a wide stepless speed adjustment direct from motor shaft. New unit is compensated for IR drop in motor armature and maintains practically straight line regulation over wide changes in load. It also includes reversing, dynamic braking, controlled and adjustable acceleration, inching forward or reverse, preset speed, automatically timed tube heating and overload, undervoltage and field-failure protection, plus added advantage of being available in any size up to 500 hp.

Units may be operated in place of stationary motor generators, or may be made portable, as they operate in any position and without any foundation. They provide any dc voltage from 0 to 270 v, or from 0 to 600 v, according to the type selected. Complete locked inclosures are provided with forced-draft cooling. *Electron Equipment Corp, 917 Meridan Ave, South Pasadena, California.*

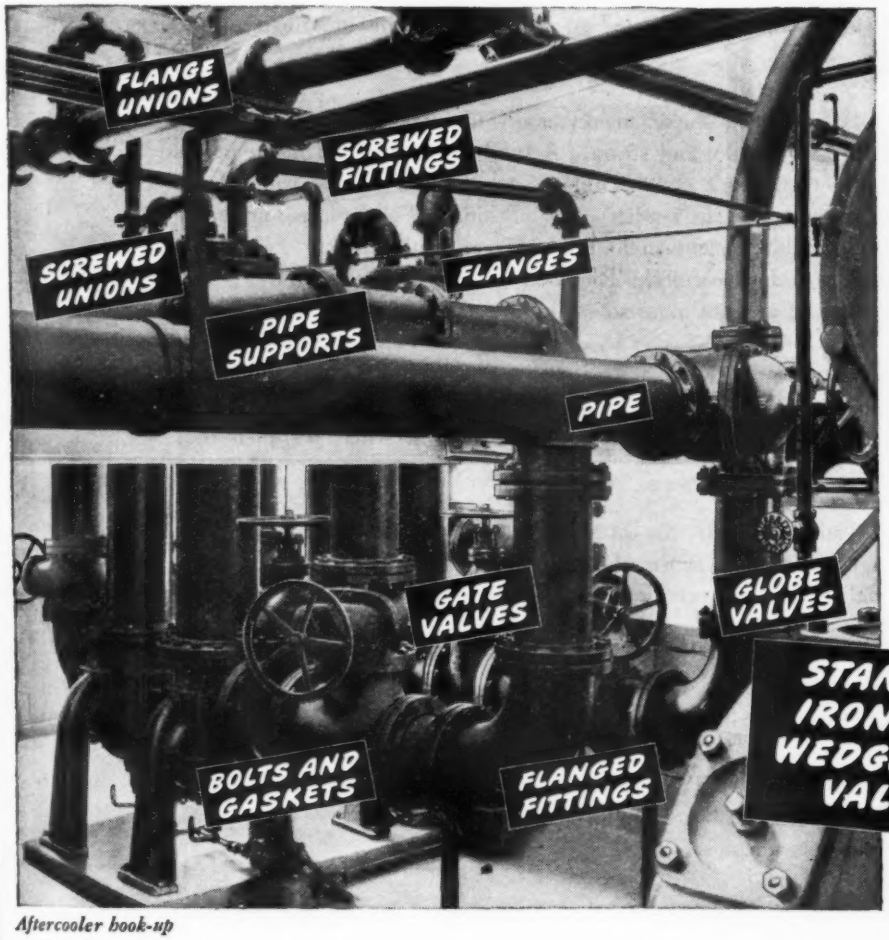
Gravity-Feed Oiler

STYLE DA ADJUSTABLE GRAVITY-FEED oiler fits wherever an adjustable drop-feed oiler of small capacity feeding filtered oil is needed. Oiler is especially suitable for slow, or medium feeds, or continuously operating machines. Oil is fed by gravity through an oil port which can be adjusted

(*Continued on page 154*)

CRANE CAN SUPPLY IT
. . . Whatever You Need in Piping Materials

ONE SOURCE OF SUPPLY
ONE RESPONSIBILITY FOR ALL PARTS
ONE STANDARD OF QUALITY



Aftercooler hook-up

It's easy to simplify and speed deferred replacement work . . . when you take advantage of Crane *complete* piping materials service. *All* your piping needs are supplied by a single source—your Crane Branch or Wholesaler. You get exactly what you need—you choose from the world's greatest line of piping materials, in brass, iron and steel. Uniform quality in all parts—and one responsibility for them—helps you get the best installations. Crane Co.'s 90 years' experience in meeting piping needs assures your complete satisfaction. In Standard Iron Body Wedge Gate Valves, for example, Crane offers the complete line listed below.

SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** with Brass trim are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S. & Y. and Non-Rising Stem patterns.

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2-in., use Crane Clamp Gate Valves.)

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. • *Branches and Wholesalers Serving All Industrial Areas*

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

ANIMAL LAW...

I've always thought that a man who did the things some Japs and Nazis have done was going back to the animals, but after thinking about it I'm not so sure. I never knew or heard of an animal that acted so low. These men are not animals, but beasts—animals gone loco.

We say pat things like: mean as a snake, sneaky as a wolf, chattering like a squirrel, crazy as a loon, obstinate as a mule, and so on. Actually, a snake isn't mean unless you pick on him, a squirrel doesn't chatter unless scared, and a mule isn't nearly as obstinate as a lot of men unless he's mistreated. Besides, a mule is a man-made sport, a crossbreed that wouldn't occur in nature. A wolf isn't sneaky—he's smart and moves easily, quickly and gracefully. The loon is nobody's fool—but his call sounds to us like the laugh of a crazy man, so we jump to conclusions.

As a matter of fact, the principal reason we get such a kick out of watching monkeys and apes is that they act just as we do—without our inhibitions. We like dogs because they're loyal even when mistreated, and detest vicious horses, when it's men that make 'em mean.

Men are worse than other animals, or better, depending on the man. We have been provided with a conscience, a sense of personal responsibility, that makes us worse than any animal when we overrule it. War is one of the times when we overrule.

Animals don't fight wars. They're not cruel and have little blood-lust, except for man's friend, the cat. Animals kill to live. Many kinds will aid a weakened comrade; all protect the female and the young. Wolves kill and eat a seriously hurt member of the pack—but they don't attack each other. Even sharks don't attack unless blood attracts them. All animals unite to destroy a member of their own group gone mad—for he endangers them all.

These aren't my opinions—they're those of such naturalists as Alan Devoe, Allee, Malinowski, Seton and Thoreau.

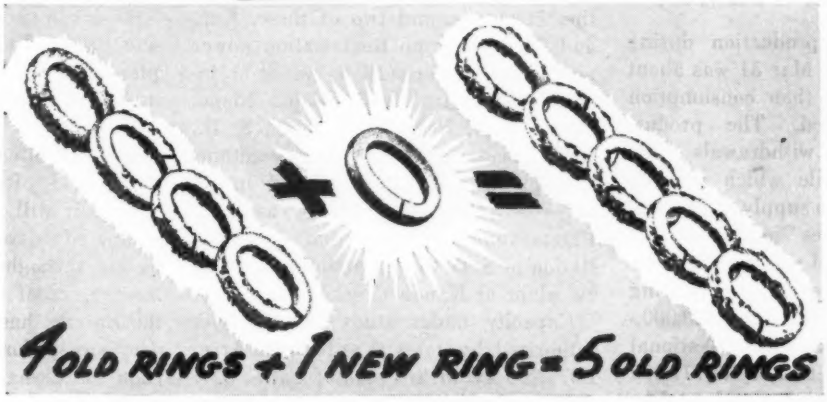
In the light of all this, the philosophy of Hitler and Tojo is completely false. They claimed that man is an animal, hence cruel and merciless, dealing out death to the weak and exulting in power. They cited the "law of the tooth and the fang" as authority for their misdeeds.

I submit that this man-made law is not a law, but a false justification for acts that no animal would stoop to commit. I believe that these men are beasts—animals gone wrong—and as such deserve the summary treatment a mad dog gets.

George Edwards
Engineer

To get the most out of a repacking job...

1. REPLACE *all* OLD PACKING



Adding a new ring or two to the old packing in a stuffing box is like adding a quart of new oil to the old, worn-out oil in your car's crankcase. It doesn't do much good. To get a packing job that will *last*—and give proper protection against scoring, (1) remove all old rings, (2) clean out the stuffing box and (3) replace with all new packing. Finally, make sure each ring is properly seated before installing the next one.

2. CUT RINGS FROM J-M KEARSARGE ROD PACKING—

NO NEED TO WORRY about too-frequent repacking when you use Kearsarge! For here is one rod packing that won't *wear* out or *dry* out in a hurry.

Designed for use against high pressure steam, Kearsarge retains its original pliability and resiliency even under continuous high temperature and high pressure service. The reason is found in its unique construction—an accordion-folded center block of asbestos cloth which forms a natural "reservoir" for the preserving lubricant and keeps the packing pliable. Additional resiliency is provided by a red rubber expansion back in the center block. Around this is a double wrapping of asbestos cloth to assure resistance to wear.

Kearsarge is one of many Johns-Manville specialized packings which are minimizing shutdowns and helping speed production in thousands of plants today. If you have a packing problem, write Johns-Manville, 22 East 40th Street, New York 16, New York.

Johns-Manville **PACKINGS & GASKETS**

THERE'S A DISTRIBUTOR NEAR YOU

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION • FUEL CONSERVATION

Coal Deficit Forces Stockpile Withdrawals

Bituminous coal production during the coal year ending Mar 31 was about 14,000,000 tons less than consumption in the same period. The production deficit forced withdrawals from the national stockpile which reduced it to less than average supply of 24 days.

Preliminary figures indicated that production in the fuel year totaled 610,000,000 tons, while consumption during the same period was between 620,000,000 and 624,000,000 tons. National stockpile on Mar 1 totaled 45,777,000 tons or almost 4,000,000 tons less than on Feb 1. Average number of days' supply Mar 1 was 24, a reduction of two from the Feb 1 total.

End of the German war does not solve the coal problem in view of the heavy requirements and manpower shortage, each of which is expected to continue into the Japanese war. Stocks of electric utilities were 12,916,000 tons on Mar 1, about 1,200,000 tons below those of Feb 1. Average number of days' supply was 58 on Mar 1, a reduction of three during Feb. Feb consumption by electric utilities totaled 6,212,000 tons, a decrease from Jan consumption of 7,119,000 tons. Daily average consumption in Feb was 221,857 tons, while in Jan it was 229,645 tons.

Reclamation Bureau Announces Power Plans

Generating capacity of existing or proposed hydroelectric plants owned or operated by Interior Department's Reclamation Bureau in 17 western states would be quadrupled to 9,324,000 kw under a postwar program involving 415 projects estimated to cost $4,792,000,000 at 1940 price levels. Existing Reclamation power plants, totaling 2,440,000 kw, would be increased to 5,052,000 kw by installations of additional units. An additional 4,271,720 kw would be installed in plants now under study.

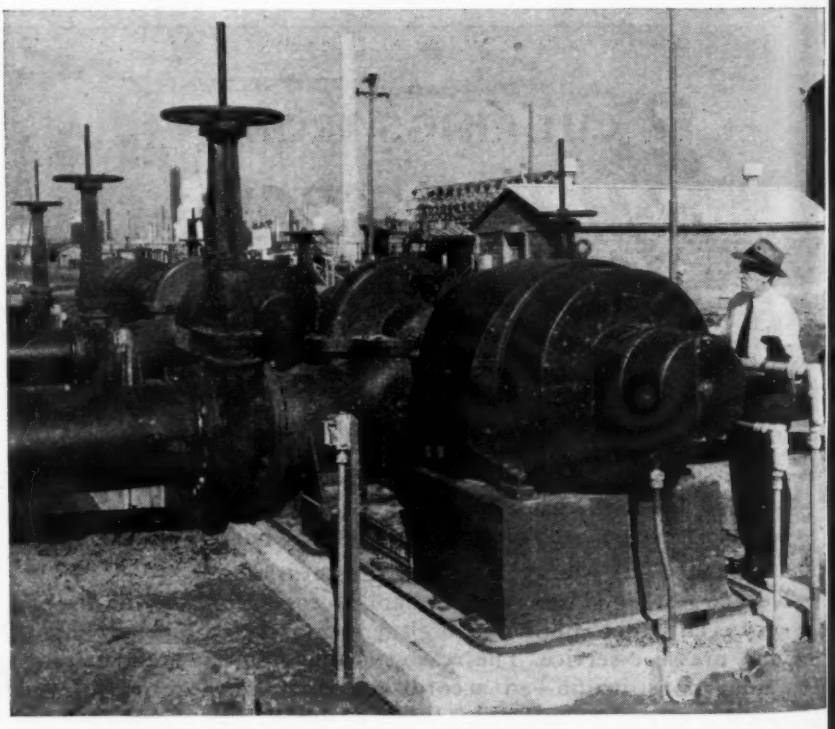
The 415 proposed "inventory" projects include 21 authorized plants and 51 new power stations under study. Four of the states, Kan., Okla., N. D., and Tex., would get no new power plants not now authorized, under the Reclamation inventory, and two of these, Kan. and Okla., have no Reclamation power now. New power stations would be installed in Ariz., Calif., Colo., Idaho, Mont., Neb., Nev., N. M., Ore., S. D., Utah, Wash. and Wyo. Already authorized plants would be installed in all these and Tex. and N. D. as well. Plants range in size from a 600-kw station in S. D. to the proposed 750,000-kw plant at Kanab Creek site in Ariz.

Capacity under study but not yet authorized, by states, is as follows: Ariz., 1,877,200 kw in five plants; Calif., 627,400 kw in eleven plants; Colo., 574,000 kw in four plants; Idaho, 138,620 kw in five plants; Mont., 31,000 kw in two plants; Neb., 75,000 kw in two plants; Nev., 16,000 kw in two plants; N. M., 102,400 kw in four plants; Ore., 7,800 kw in two plants; S. D., 600 kw in one plant; Utah, 124,700 kw in four plants; Wash., 622,000 kw in one plant; and Wyo., 75,000 kw in eight plants.

Bureau of Reclamation has progressed from early projects which were small and often unrelated to where shortly it will complete reports on coordinated development of 15 river basins throughout the West. John L. Savage, chief designing engineer for the Bureau, has recently made preliminary surveys for the huge Yangtze Gorge Dam for China, in which it is planned to install 96 generators of 110,000-kw capacity each.

(*Continued on page* 176)

PLENTY BIG PUMPS FOR REFINERY



Driving water circulating pumps at a cooling-tower base of the world's largest single-fluid catalytic cracking unit are these three synchronous motors of unique splashproof construction that permits them to be installed outdoors. The motors are General Electric, rated 450 hp at 900 rpm, with direct-connected exciters and the pumps are Ingersoll-Rand, rated 12,000 gpm at 125-ft head. These units are located at Tide Water Associated Oil Co's Avon, Calif., 100-octane refinery, which began operations in mid-February of this year. The three pumps have a total capacity of over 50,000,000 gal per day

*"JOE, a Chief Engineer at a brewery says—"The boiler water treatment we are using does a good job on the boilers but it damages the packing on the line and valves. The compound was changed once with disastrous results."

Source: Survey conducted by a well-known power publication.

you are right Joe...

there is such a thing as too much water treatment*

...says

A. H. Webber

Nalco Representative,
Philadelphia, Pa.

TAKE your case for example, Joe ... the boiler feed water treatment you are now using may do a good job in the boiler but if it damages the packing in the lines and valves —*you may be overtreating the water.* A Nalco survey could determine the *exact* kind of treatment best suited to your plant conditions ... and would eliminate the possibilities of *hit or miss* treatment that accomplishes one thing at the expense of another.

For top plant efficiency do not *under-treat* or *over-treat* boiler feed water. Your first step? ... ask for a Nalco survey. Learn about Nalco, the system of *scientific* water treating. There is no obligation.

Photo in Nalco Laboratories

Nalco

SYSTEM OF SCIENTIFIC WATER TREATING SERVICE ... FOR ALL INDUSTRY

NATIONAL ALUMINATE CORPORATION 6222 West 66th Place Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

Introducing

A NEW SERIES of the popular Jenkins Piping Layouts . . . to appear each month in these pages. Watch for them.

For cooling water, boiler feed makeup, and other industrial purposes, a source of water not suitable for drinking is used in many plants. It is essential to provide an auxiliary supply of city water to supplement or completely replace the service water supply.

City and state laws require that contamination of the city water be made impossible. As indicated in the layout, this is effected by eliminating back pressure and, hence backflow, through the use of a vented tank.

Backflow is further prevented through the use of check valves in both the feeds and the discharge from the tank.

To break any siphon action that might tend to lift water out of the tank back into the city lines, most codes require the use of a vacuum breaker valve as an additional precaution. This layout also includes typical water meter connections required to allow for meter testing and to guard against backflow through the meters.

Valves other than bronze may be used, although for the usual city water supply these are best. Where analysis shows the water free from corrosive elements, valves made of other metals may be substituted.

Local building codes obviously could not be allowed for, although this layout represents good practical valve selection. Jenkins recommends consultation with accredited piping engineers and contractors, either when adapting these suggestions to your own requirements, or when planning major piping installations.

Copies of this layout, No. 1, with complete details of all valve specifications, will be furnished on request by Jenkins Engineers.

Jenkins PRACTICAL PIPING LAYOUTS

CITY WATER SUPPLY TO CONTAMINATED WATER SYSTEM — 1

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

1. **Place valves correctly in the line.**
2. **Use the right type valve for the service.**
3. **Choose Jenkins Valves for lifetime economy.**

OVER 600 VALVES TO FIT YOUR PLANS

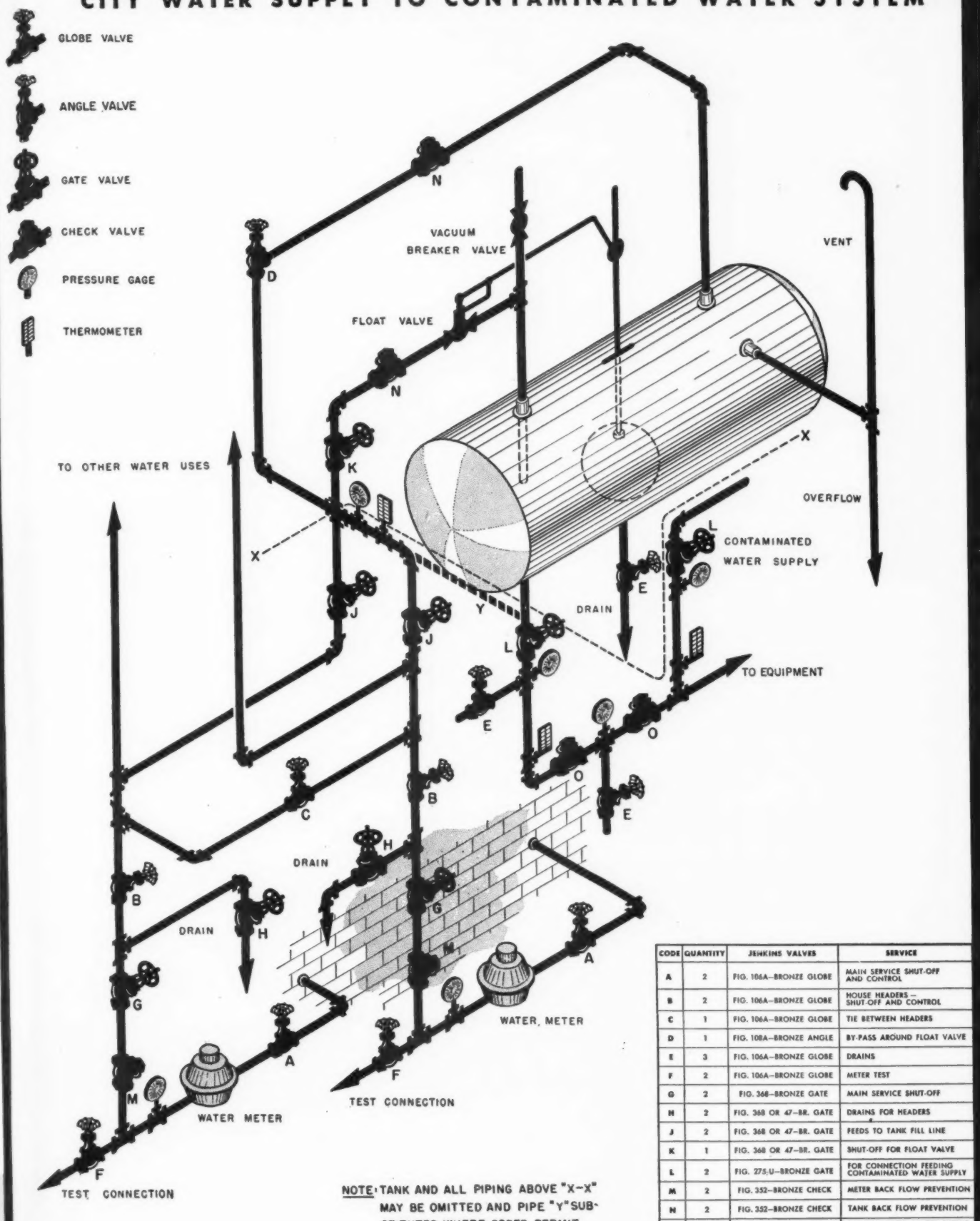
When you plan your piping layouts, you will rarely need a valve you can't find in the Jenkins Catalog. Over 600 different patterns are listed for commercial, industrial, engineering, marine, and plumbing-heating services – in bronze, iron, air furnace malleable iron, steel, and corrosion resisting alloys.

That means you save time, by selecting all the valves you need from one source. It also means you get the advantages of Jenkins *better* design, *better* materials, and *better* workmanship for every control point on your lines . . . at no higher cost than for other good valves.

Jenkins Bros., 80 White Street, New York 13: Bridgeport: Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London, England.

Since 1864 **JENKINS VALVES**

CITY WATER SUPPLY TO CONTAMINATED WATER SYSTEM



CODE	QUANTITY	JENKINS VALVES	SERVICE
A	2	FIG. 106A—BRONZE GLOBE	MAIN SERVICE SHUT-OFF AND CONTROL
B	2	FIG. 106A—BRONZE GLOBE	HOUSE HEADERS — SHUT-OFF AND CONTROL
C	1	FIG. 106A—BRONZE GLOBE	TIE BETWEEN HEADERS
D	1	FIG. 108A—BRONZE ANGLE	BY-PASS AROUND FLOAT VALVE
E	3	FIG. 106A—BRONZE GLOBE	DRAINS
F	2	FIG. 106A—BRONZE GLOBE	METER TEST
G	2	FIG. 368—BRONZE GATE	MAIN SERVICE SHUT-OFF
H	2	FIG. 368 OR 47—BR. GATE	DRAINS FOR HEADERS
J	2	FIG. 368 OR 47—BR. GATE	FEEDS TO TANK FILL LINE
K	1	FIG. 368 OR 47—BR. GATE	SHUT-OFF FOR FLOAT VALVE
L	2	FIG. 275-U—BRONZE GATE	FOR CONNECTION FEEDING CONTAMINATED WATER SUPPLY
M	2	FIG. 352—BRONZE CHECK	METER BACK FLOW PREVENTION
N	2	FIG. 352—BRONZE CHECK	TANK BACK FLOW PREVENTION
O	2	FIG. 352—BRONZE CHECK	CONTAMINATED WATER SUPPLY BACKFLOW PREVENTION

NOTE: TANK AND ALL PIPING ABOVE "X-X" MAY BE OMITTED AND PIPE "Y" SUBSTITUTED WHERE CODES PERMIT.

BRONZE ★ IRON ★ STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

TRADE JENKINS MARK

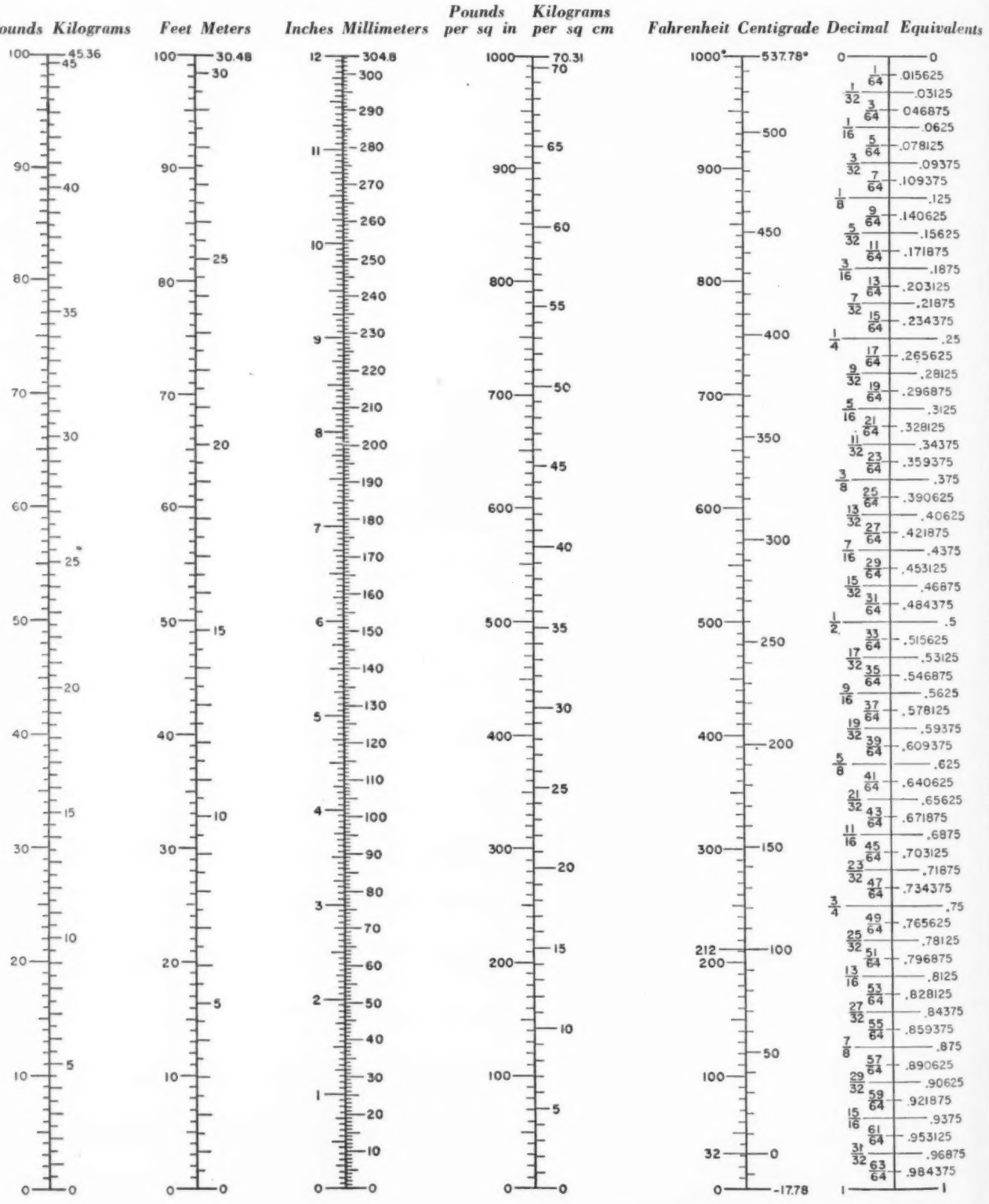
TRADE MARK

Jenkins Bros

POWER'S DATA SHEETS

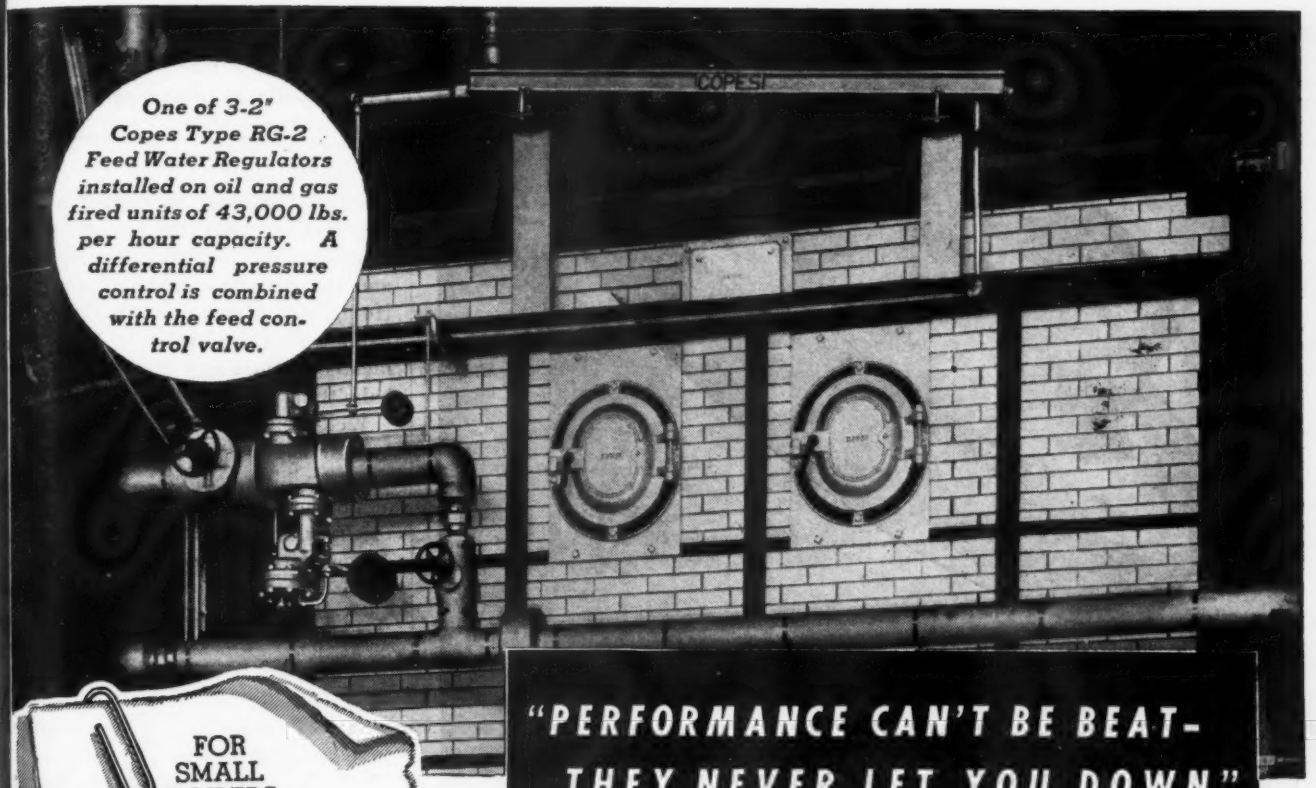
Number 154

Metric-English System Equivalents



Courtesy Reed Roller Bit Co.

© POWER



One of 3-2" Copes Type RG-2 Feed Water Regulators installed on oil and gas fired units of 43,000 lbs. per hour capacity. A differential pressure control is combined with the feed control valve.

"PERFORMANCE CAN'T BE BEAT— THEY NEVER LET YOU DOWN"

That's THE EXPRESSED OPINION of a Chief Engineer concerning his Copes Feed Water Regulators. It typifies the experience of Copes users everywhere, who have grown accustomed to effective, dependable feed water control.

Reasons why Copes Regulators perform exceptionally well, are:-

(1) Fully Automatic continuous feed in accordance with demand.

(2) Utilization of the simplest principle without mechanical complications. Few parts—all sturdy.

(3) Positive response to level changes 5 to 8 times faster than other devices. No perceptible lag.

(4) Overwhelming ratio of power to friction.

(5) Most closely balanced valve plungers made—no "chatter" or "jumping".

(6) Port areas individually designed for the installation. No over— or under-sizing.

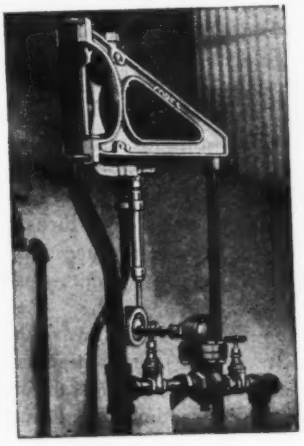
These features, plus others, assure the Copes user of a big return on a small investment. Full details in Catalog 12-44, sent promptly upon request.

NORTHERN EQUIPMENT CO • 651 Grove Drive, Erie, Pa.

FEED WATER REGULATORS • PUMP GOVERNORS • DIFFERENTIAL VALVES
LIQUID LEVEL CONTROLS • REDUCING VALVES AND DESUPERHEATERS

BRANCH PLANTS IN CANADA AND ENGLAND **REPRESENTATIVES EVERYWHERE**

FOR SMALL BOILERS



On small boilers at moderate ratings and pressures, the COPES Type OT quickly pays for itself with correct, continuous feed that means more steam per pound of fuel. Makes operation safer by stabilizing water level. Fully-automatic, it saves time for operators.

☆ *For* **SAFETY** *and* **ECONOMY** *Specify*

COPES

Most industrial piping fabricators depend upon outside sources for flange requirements. Not so with Associated. Since we manufacture flanges we are in a position to supply the needs of our fabrication division at all times . . . and quickly. That is one reason why Associated jobs progress more rapidly, efficiently. What is equally important, it costs our customers not one extra penny to receive this EXTRA benefit of Associated service.

ASSOCIATED PIPING & ENGINEERING CO., Inc.
2332 East 38th Street • Los Angeles 11, California

ASSOCIATED *Progressive* **PIPING**

Centrifugal Pumps

(*Continued from page* 118)

Basis of this claim is that, if one has anti-friction and the other babbitt bearings, the babbitt bearings wear and throw the two shafts out of line. However, if a pump and its driver have babbitt bearings, wear in their bearings is unequal and realignment or re-babbitting is periodically necessary.

Well-designed properly lubricated babbitt bearings wear very slowly and the flexible coupling between the pump and driver shafts compensates for the resulting slight misalignment for a considerable period. Regardless of bearing type on driver and pump, check alignment periodically and correct if necessary. It is immaterial whether bearings are similar.

Q 14—Why are thrust bearings used on double-suction pumps?

A—A double-suction pump theoretically should be in axial hydraulic balance but rarely is. A pump is primarily a product of a foundry and minor irregularities result that may cause differences in eddy currents around the impeller, which produce an axial hydraulic thrust. Conditions in the suction piping may cause hydraulic unbalance of the pump's impeller. A thrust bearing to take thrust in either direction is therefore necessary to keep the impeller in its proper position.

Q 15—What is axial hydraulic thrust?

A—It is the summation of unbalanced forces acting on an impeller in an axial direction. Single-suction impellers, if wearing rings are not provided in the back, are subject to an axial thrust because they expose more back-wall surface to the discharge pressure than the opposed front wall, a portion of the front wall being exposed to the suction pressure.

Q 16—How can axial thrust be balanced in a single-suction pump?

A—Balance can be achieved by providing wearing rings of the same inside diameter on the suction and back side of the impeller and having balancing holes through the latter, Fig. 10 and 11. In multi-stage pumps all impellers may face in the same direction and the pump be provided with a hydraulic balancing device, Fig. 12. As an alternate, an even number of impellers may be used and divided in two equal groups. The two groups face in opposite directions, Fig. 13, so that axial

WANT BETTER VALVE SERVICE?

Quick-acting threads speed opening and closing ... won't stick or freeze
Full pressure repacking ... pressure is not transmitted to the stem
Longer wearing seats & plugs which can be superhardened for extra severe service
CHAPMAN

PATENT NO. 1,866,292

Get CHAPMAN LIST 960

Chapman List 960 valves in sizes from ¼" to 2"—carbon steel for pressures to 800 pounds; alloy steel for pressures to 1,000 pounds at 750° F. For higher pressures, specify List 990.

THE CHAPMAN VALVE MFG. COMPANY
INDIAN ORCHARD, MASSACHUSETTS

"WATER HAMMER" COSTS YOU MONEY!
. . . by serious breakdowns in Pumps and Piping Systems

WILLIAMS-HAGER FLANGED Silent CHECK VALVES

Precision Engineered to Eliminate "HAMMER and BANG" in ANY system with Operating Pressures up to 6,000 lbs.

Heavy duty service records upwards of 17 years without removal from lines . . . Williams-Hager Flanged Silent Check Valves are built to meet the exacting requirements of any end use. No webs to restrict or hamper the flow of liquids . . . the free-floating valve will operate normally and efficiently in *any* position.

Dependably constructed in sizes from 1" to 20" inclusive, from iron, semi-steel, bronze, cast steel, stainless steel or monel . . . pressure resistant to 6,000 pounds.

Do you have the new Williams Catalog for Power Plant Equipment?

specified by Leading Industries for such exacting uses as:

Public Utilities • Water Works • Industrials • Oil Refineries • Paper Mills • Hotels • Hospitals • Chemical Works • Office Buildings • Public Buildings • Breweries • Steamship Lines, etc.

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

thrust of one is about balanced by that of the other.

Q 17—What impeller arrangements are commonest for multi-stage pumps?

A—(1) Several single-suction impellers may be mounted on one shaft, each having its suction facing in the same direction and the stages following in the ascending order, Fig. 12. Such a pump requires a hydraulic balancing device.

(2) An even number of single-suction impellers are mounted on one shaft, half facing in one direction and half facing opposite, Fig. 13.

(3) An uneven number of single-suction impellers are used, and shaft and interstage bushing diameters chosen to give the effect of a hydraulic balancing device to compensate the hydraulic thrust of one stage.

(4) Any number of double-suction impellers may be mounted on one shaft.

Q 18—What is a balancing drum and balancing drum head?

A—Rotating part of a radial-clearance hydraulic balancing device, Fig. 12, is a balancing drum, and its stationary part a balancing-drum head.

Q 19—How does a balancing drum balance axial thrust?

A—The balancing chamber beyond the last-stage impeller, Fig. 12, is separated from the pump interior by the balancing drum and drum head. The balancing chamber connects either to the pump suction or suction source. Therefore balancing-chamber pressure is practically that on the suction with discharge pressure acting on the opposite drum face. Then by proper design a balancing-drum diameter is selected to balance the axial hydraulic thrust completely or within 90 to 95%, depending on whether the thrust bearing is to carry a portion of the axial thrust.

Q 20—What is a balancing disk and balancing-disk head?

A—Rotating part of an axial-clearance hydraulic balancing device, Fig. 14, is a balancing disk, the stationary part a balancing-disk head.

Q 21—How does a balancing disk balance axial thrust?

A—The balancing disk is fixed to and rotates with the shaft, being separated from the balancing-disk head by a small axial clearance. Leakage through this clearance flows into the balancing chamber and to the pump suction or suction source. Balancing-chamber-pressure exists on the balancing disk's back while its face is acted upon by an intermediate pressure be-

The fittings that snuggle up

IT makes a lot of difference, when you're laying out a piping system, whether you use Tube-Turn welding fittings that snuggle up to each other going around corners—or other type fittings that demand a world of "elbow room." Lines can be placed nearer to ceilings and walls and nested closer in smaller tunnels.

Other important advantages of Tube-Turn welding fittings include lighter weight, greater strength, and longer life. Their streamlined design permits easier insulation, and the fact that they are permanently leakproof means that insulation will not have to be replaced. Smooth turns insure maximum efficiency of flow.

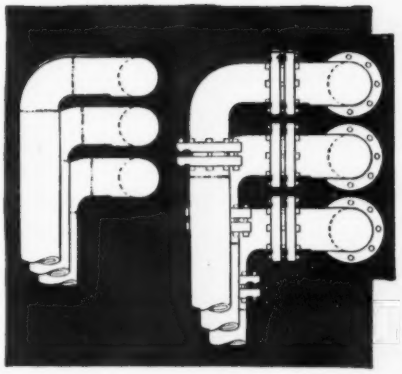
Specify Tube-Turn welding fittings for your next piping job, and gain all these money-saving benefits!

For complete information on the superiority of Tube Turns' exclusive manufacturing methods and data on successful installations in many industries, write for Catalog 111.

• • •

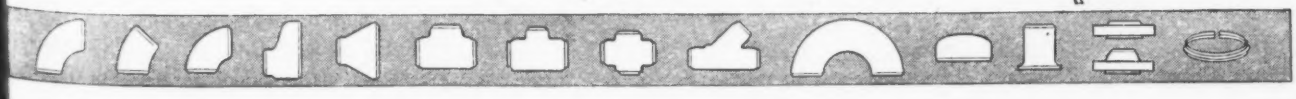
Selected Tube Turns Distributors in every principal city are ready to serve you from complete stocks.

TUBE TURNS (Inc.), Louisville 1, Kentucky. Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle, Los Angeles.



See how much less space is required for compound turns made with Tube-Turn elbows!

TUBE-TURN TRADE MARK *Welding Fittings and Flanges*



Intense heat, high pressures, violent agitation cause weaker molecules in oil to break down—become susceptible to oxidation and polymerization—form gums, resins, asphaltenes. When this happens, oil becomes tired . . . unable to do its vital job.

Result—piston lacquering, bearing failures, premature engine wear, increased upkeep and excessive oil consumption.

Briggs Oil Clarifiers prevent the disastrous results of tired oil. They remove the visible contaminants in oil . . . dust, metal chips and grit. They remove the invisible products of oxidation . . . gums, resins, asphaltenes. Oil clarified in a Briggs Clarifier does a better job longer, maintenance is lowered, trouble is prevented.

Ask the Briggs Distributor in your locality for the facts about the advantages of continuous maintenance of lube oil, the importance of clean Diesel fuel oil. He will show you how and why Briggs Clarification goes far beyond ordinary filtration.

There is a Briggs Oil Clarifier for every size and type internal combustion engine . . . for every type of oil . . . for practically every purpose.

Consult Briggs FIRST on any filtration problem.

ARMY NAVY

Briggs

BRIGGS CLARIFIER CO. PIONEERS IN MODERN OIL FILTRATION **Washington 7, D.C.**

Representatives in Principal Cities—listed in the "Filter" section of most classified telephone directories

tween discharge pressure at the disk's smallest diameter and balancing-chamber pressure at its periphery. Inner and outer disk diameters are so chosen that the difference between the force acting on the disk's face and that on its back balances the axial thrust of the impellers.

If the impeller's axial thrust increases, the excess pressure moves the rotor to reduce the clearance between balancing disk and disk head. This reduces the flow through the clearance and lowers balancing-chamber pressure until pump axial thrust is again balanced. Similarly, a reduction in axial thrust causes an increase in clearance between the disk and disk head. As a result of increased flow, pressure increases in the balancing chamber until the axial hydraulic thrust is again balanced.

Q 22—What is a combination balancing disk and drum?

A—In modern practice, a simple balancing disk is not commonly used, a combination device with both axial and radial clearances being employed, Fig. 15. Such a device is called a combination balancing disk and drum.

Reader's Problems

(*Continued from page* 113)

pulley combinations could also be used.

By switching the driving motor on or off as indicated by the *fast* or *slow* indication of the synchronoscope, the unit can be brought into synchronism and paralleled. Then adjust field current for the power factor required. The synchronous machine should be protected by inverse time overload relays set for about 200% full-load current with two seconds delay. This prevents tripping on slight line disturbances.

While this installation corrects power factor from the point of connection back to the generating station, it does not ease the burden on feeders within the plant. Static condensers have lower losses than a synchronous unit and are consequently less costly to operate. They have the further advantage that they can be installed at points where correction is most needed.

Perhaps a survey of the plant will show that installing individual feeder capacitors at the proper locations will result in a considerable saving over a period of years.

Hamilton, Ont. J A COULDEN

(*Continued on page* 142)

KEEP ORIGINAL PIPE STRENGTH

ON MULTIPLE BRANCH OUTLETS BY WELDOLET METHOD

Three types of WeldOlets are available — Welding Outlets, Threaded Outlets, and Socket Outlets.

Even on an installation like this—with a number of branch outlets close together—the WeldOlet method easily maintains full original pipe strength. You get these strong permanent, leakproof joints without reinforcing or bracing no matter how many branches you require.

High flow efficiency is another important WeldOlet advantage. The funnel-shaped opening of the fitting permits smooth flow, with a minimum of turbulence and friction. The design of the fitting makes it impossible for the branch to project into the main pipe and cause an obstruction. Furthermore, after installation, you can inspect the opening for freedom from icicles before the branch is connected.

WeldOlet fittings are drop-forged for maximum strength. Available in size-to-size and reducing sizes from ¼" to 24". For complete information, write for Catalog.

BONNEY FORGE & TOOL WORKS • *342 Green Street, Allentown, Pa.*

WELDOLETS

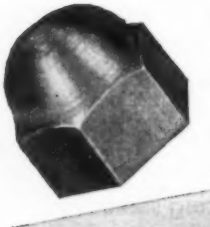
TRADE MARK REG. U. S. PAT. OFF. PAT. IN U. S. & FOREIGN COUNTRIES

WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET

For Welded Branch Pipe Outlets

YES . . . the **An-cor-lox** lock nut locks tight the first time it is turned down on the work . . . and *increases* its locking capacity under vibration, shock or impact every time it is re-used. The excellent wedging produced by the flattened locking ring is not impaired . . . it actually increases in gripping power.

Skeptical? Then put it to the test! And let us send you our latest descriptive data.



An-cor-lox
Lock Nuts

An-cor-lox Division
LAMINATED SHIM COMPANY, INCORPORATED
61 Union Street • Glenbrook, Conn.
2225

Why Not Install Amortisseur Winding?

UNLESS an amortisseur winding is provided, the machine cannot be started as an induction motor. Some generators have pole pieces that are already pierced for amortisseur bars. If no holes are present, and if the pole tip is deep enough, pole face may be slotted with T-shaped slots properly spaced. Then with a pilot drill, change the slot into a round hole. Slot spacing should differ by about 20% from that in the stator. However, before doing any machine work on the poles obtain the manufacturer's approval and advice as to stresses and possible throttling of the magnetic flux.

If it turns out to be feasible to add an amortisseur winding use a starting compensator to reduce the line voltage to a suitable value, possibly 35%. Check this with the manufacturer.

Starting can also be accomplished by belting or coupling a wound-rotor induction motor to the generator. If the speed is low use generous-sized belt and pulleys. If the speed is high (600 rpm or more) consider direct coupling.

If the generator pf is 0.8, then about 70 to 75% of its kva rating can usually be obtained as a condenser. Sometimes the capacity can be increased by placing sheet-iron shims under the poles to reduce the air gap. Provide the voltage regulator with a stop to prevent it applying more than a safe value of field current.

Schenectady, N. Y. L W RIGGS

Modify the Voltage Regulator

IT WILL undoubtedly be better to start the synchronous motor with a small induction motor, and throw it on the line when it is up to speed. However, if the power supply has plenty of capacity, the starting transformer method may be preferred. I suggest that *CLF* consult the power company about this.

The salient pole generator not being equipped with a squirrel-cage winding will not start readily as an induction motor. It may have brass short-circuiting rings around the pole tips which give it some of the characteristics of a squirrel-cage machine; these make starting and synchronizing possible.

In starting *CLF's* motor either by throwing it across the line or through a starting transformer the field winding must be closed through a resistance to avoid high induced voltages in the field windings. These are dangerous not only to insulation but to life as well, if the

"BOY— *bring me a pipe stretcher!*"

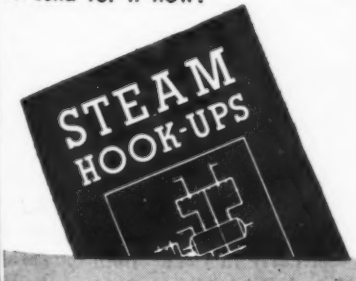
Unreasonable demands are made on the steam engineer every day, and many's the time he would like to call on his helper for tools that would enlarge the capacity of his lines, heating coils, and even the boiler.

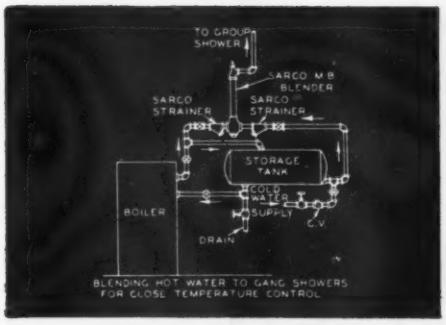
The actual fact is that, if the boy came back with a basketful of Sarco steam traps and controls, the job could be done with a pipe cutter and a wrench.

This in a nutshell is Sarco Service — To get more heat to the job by correctly dripping the lines. To use more of the heat before it leaves the coils, by individual trapping, and to regulate temperatures — both in heating and cooling, all over the plant.

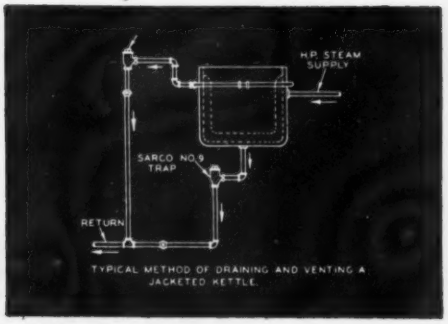
Time and again steam process production has been increased 25 to 50%, or the steam used greatly reduced, or the amount of metered water cut 50% or more.

The Sarco Hook-Up book contains a hundred or more ideas, with recommendations and sketches, and tells how each Sarco product will fit into your plant operation. Why not send for it now?

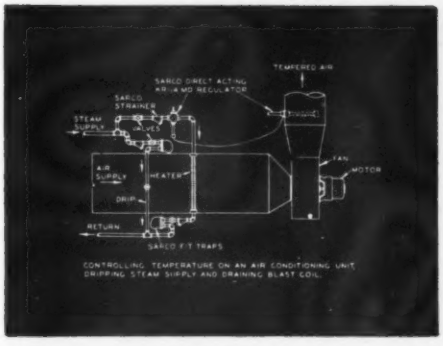




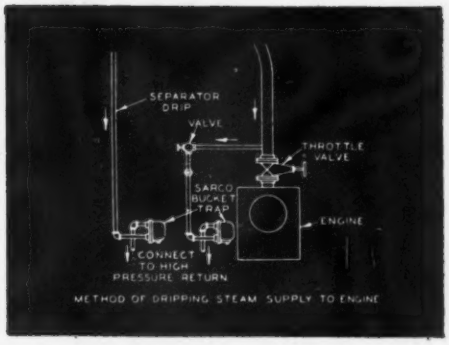
BLENDING HOT WATER TO GANG SHOWERS FOR CLOSE TEMPERATURE CONTROL



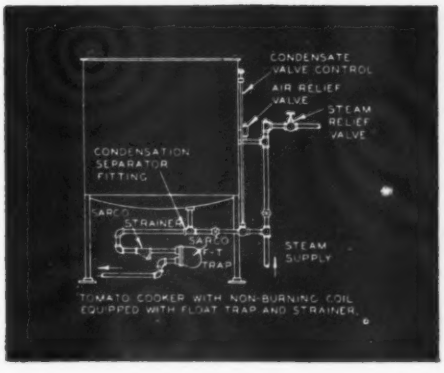
TYPICAL METHOD OF DRAINING AND VENTING A JACKETED KETTLE.



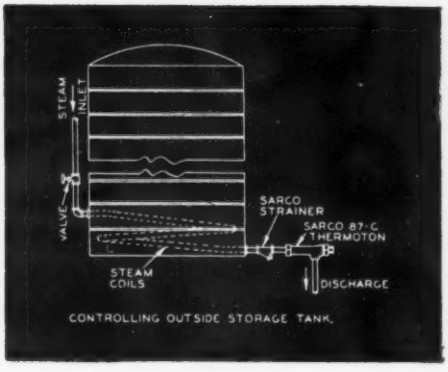
CONTROLLING TEMPERATURE ON AN AIR CONDITIONING UNIT DRIPPING STEAM SUPPLY AND DRAINING BLAST COIL



METHOD OF DRIPPING STEAM SUPPLY TO ENGINE



TOMATO COOKER WITH NON-BURNING COIL EQUIPPED WITH FLOAT TRAP AND STRAINER.



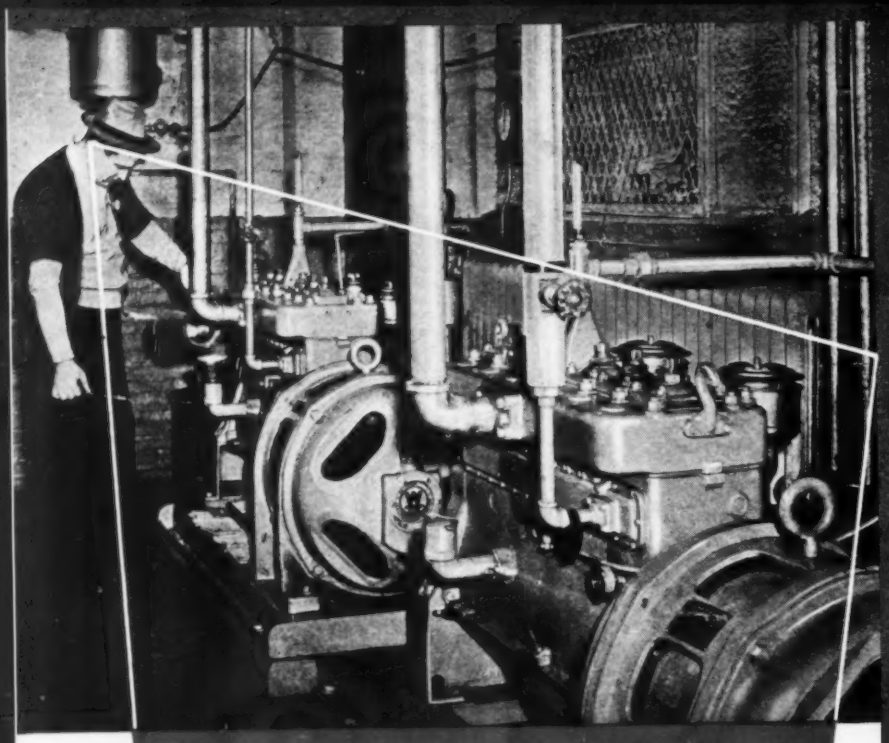
CONTROLLING OUTSIDE STORAGE TANK.

SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.
Represented in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

36



YOU SAVE
WHEN YOU INSTALL
SCHRAMM
AIR COMPRESSORS
IN UNIT SYSTEMS

Here is an interesting illustration of two Schramm Air Compressors at work, furnishing air in a plant where there is regularly a demand for medium amount of air—and an *occasional* peak load which requires a lot of electrical current and air. The two compressors take care of the *variation* of needs for much and little air.

Schramm compressors have 3 outstanding features that make them economical and easy to operate: (1) 100% water-cooled, (2) lightweight and compact, (3) vibrationless, even when providing great amounts of air.

These—and many other features—make Schramm Air Compressors the best compressors for your plant. Write today for full data.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

field is open. When the machine reaches full speed disconnect the resistance and apply direct-current excitation. The machine will then pull into step and operate as a synchronous motor.

If the unit is brought up to speed with an independent motor it will take considerable power to drive it as a generator with the field excited so that too small a driving motor should not be used. Synchronize the machine the same as if it were a generator. Unless this is a large machine it would appear best to leave the voltage regulator off and adjust the excitation by hand for the power factor desired.

Synchronous machines have the inherent characteristic of stabilizing the line voltage. The condenser will be unable to change the line voltage to any extent and changes in its excitation will be reflected in power factor changes. Starting with a weak field and increasing the excitation raises the power factor and reduces the machine's stator current until unity power factor is reached. Increasing the field current further, again increases the stator current and makes the power factor leading.

Unless the voltage regulator is connected for power-factor control, it is liable to do more harm than good. If there is a wattmeter in the circuit it can be used in conjunction with the ammeter to indicate leading or lagging power factor. This cannot be determined by the ammeter alone unless the excitation is changed and the change in amperes noted. It will not be difficult to modify the regulator for power-factor correction.

Carlsbad, N. M. GENE ABEL

Mineral-Free Water

(*Continued from page* 102)

quality of the raw and demineralized water is given in Table II. Cost of regenerating chemicals is 2.9 cents per 1000 gal of demineralized water.

A typical medium-sized plant designed to deliver 55 gpm was installed at a synthetic plastic factory in the Midwest early in 1942. Both the Zeo-Karb H and De-Acidite units are of rubber-lined steel and have rubber-lined interconnecting piping. Table III shows the quality of the raw and demineralized water. Chemical cost is 8 cents per 1000 gal of treated water. A duplicate is now being installed.

A large installation was made at

BOILED DOWN

TO SIMPLIFY MOTOR SELECTION

● **This new booklet gives ratings, sizes, characteristics, dimensions, where-to-use data, *and prices* of General Electric a-c and d-c motors, 1/16 to 75 hp. Everything you need to know to select these sizes—all in 16 pages!**

Builders of TRI-CLAD Motors

Buy all the BONDS you can—*and keep all you buy*

To Save Your Time Later Mail This Coupon Today—

General Electric Company, Schenectady 5, N. Y.

Please send me a copy of your Condensed Motor Catalog (No. GEA-4281).

Name.....

Company.....

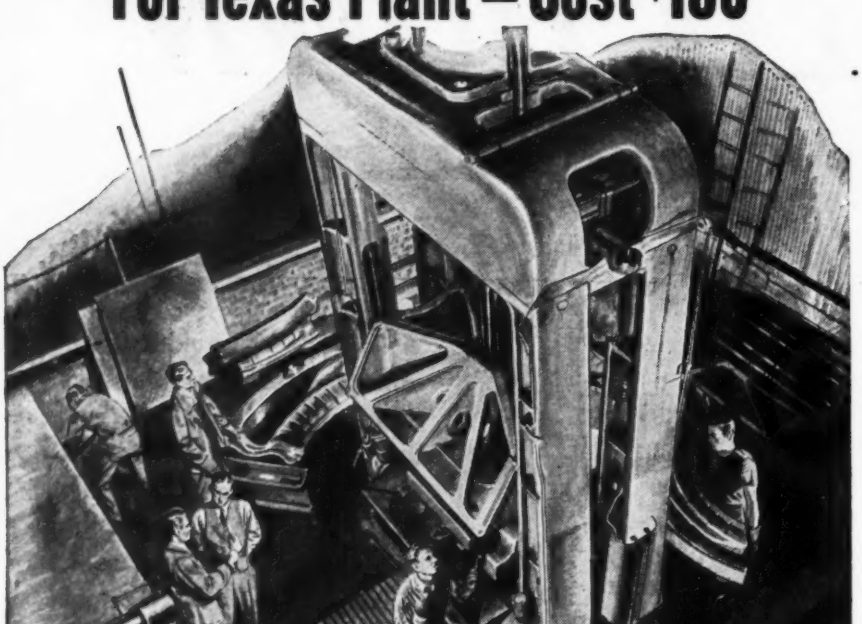
Address.....

City.....**State**.....

750-258-488

GENERAL ELECTRIC

Air Express Saves $2,000 For Texas Plant — Cost $180



2 P.M. TUESDAY — Drop-hammer press breaks down in Texas war plant. Nearest replacement part is in the East, over three normal shipping days away. To avoid costly shutdown, the manager telephones for a new part via Air Express, even though the part weighs 250 pounds.

7 A.M. WEDNESDAY — Replacement part lands at Texas airport. Air Express charges were $180. But manager figures a saving to the plant of three precious production days and a saving of $2,000 in overhead by avoiding a shutdown.

FIGURE IT OUT yourself. How much would it cost you per day if your business — or a part of it — came to a standstill for lack of essential parts or material? Remember, the nation's inventory is within hours of your door, via Air Express.

Specify Air Express — Low Cost for High Speed

25 lbs., for instance, travels more than 500 miles for $4.38, more than 1,000 miles for $8.75, more than 2,000 miles for $17.50, at a speed of three miles a minute — with cost including special pick-up and delivery in all U. S. cities and principal towns. Same-day delivery between many airport towns and cities. Rapid air-rail service to 23,000 off-airline points in the United States. Direct service to scores of foreign countries.

AIR EXPRESS

GETS THERE FIRST

Write Today for "Quizzical Quizz," a booklet packed with facts that will help you solve many a shipping problem. Railway Express Agency, Air Express Division, 230 Park Avenue, New York 17. Or ask for it at any Airline or Express office.

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION

Representing the **AIRLINES** of the United States

catalyst manufacturing plant early this year to supply 1000 gpm of demineralized water for process use. Raw water supply from the Delaware River has an electrolyte content of about 150 ppm (expressed as $CaCO_3$) throughout most of the year. However, during autumn drought periods, chloride content rises considerably because sea water flows up the river. During these periods, all the water required is pumped from the river during low tide into large reservoirs capable of supplying the plant requirements between pumping periods. However, the electrolyte content of this water is still much higher than during normal river conditions. For treatment, the water passes from the reservoirs to a coagulating basin, to filters, and then through the demineralizing plant.

To conserve critically important war materials, the cation and anion exchangers are wood-stave gravity units, Fig. 2. The installation consists of four large Zeo-Karb H and De-Acidite units. To avoid pumping Zeo-Karb H treated effluent through the De-Acidite units, the former are located on the floor above the De-Acidite units.

Quality Obtained

Table IV shows the quality of demineralized water obtained at this plant with normal river conditions as well as with water during drought periods. Quality is somewhat better when the electrolyte content of river water is lower. However, a satisfactory effluent is obtained during droughts. Cost of regenerating chemicals varies with the amount of electrolyte in the river water. During normal river conditions, column *A*, chemical cost is 3½ to 4 cents per 1000 gal, whereas during drought periods, column *B*, cost of treatment increases to 11 to 12 cents per 1000 gal.

Remember that the anion exchanger removes only acids present in the effluent of the hydrogen-cation exchanger. If the effluent contains any salts, they pass through the anion exchanger and are present in the demineralized water. Therefore, to assure good quality demineralized water, it is important to have complete metallication removal upon passage of the water through the hydrogen-cation exchanger.

All bicarbonates in the influent to a hydrogen-cation exchanger are completely converted to carbonic acid. However, the salts present as sulphates and chlorides, which together are frequently called the *Theoretical Mineral Acidity* (ThMA), are not entirely converted to their respective acids. The

COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Address Coppus Engineering Corp., 124 Park Avenue, Worcester, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 166 PARK AVENUE, WORCESTER 2, MASS.
Please send me information on the Blowers that clear the air for action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have).

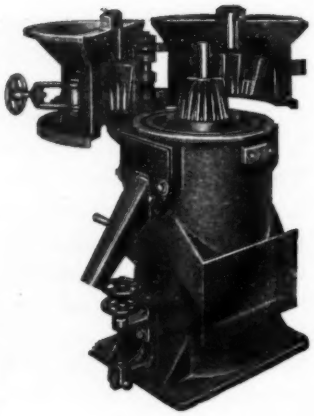
During This Coal Crisis Know the Grades You Have to Burn . . . . . .

crush and sample automatically and quickly— process one ton in one hour . . .

WITH THE

STURTEVANT

Automatic



Coal sampling by the old-fashioned hand method of shoveling, hand-crushing, mixing, quartering, piling and rolling not only involves many slow, laborious operations but every chance of human error is always present. Samples are not representative even at an unnecessary expenditure of manpower.

WHY It Pays to Know Your B. T. U.'s

Only by taking accurate, truly representative samples can you know exactly the fuel value of the coal you buy, provide a correct basis for adjusting your plant to the efficient use of the coal delivered to your bunkers and assure freedom from shut down. By sampling coal the "Sturtevant Way" you can be absolutely certain of its B. T. U. value and thereby assure the maximum in plant performance, capacity and economy.

SEND FOR BULLETIN

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston 22, Mass.

actual amount of hydrochloric and sulphuric acids produced upon passage through the hydrogen-cation exchanger is called the *Free Mineral Acidity* (FMA). Difference between the ThMA and the FMA represents the amount of salts present as chlorides and sulphates that have not been converted to their respective acids.

If a constant amount of acid per cu ft is employed for regenerating a hydrogen-cation exchanger, the difference between ThMA and FMA in the effluent will be greater if the water's ThMA is higher. On the other hand, when treating a given water, the difference between ThMA and FMA can be reduced by employing more acid per cu ft for regenerating the cation exchanger.

Table IV clearly indicates that poorer quality demineralized water is obtained when the ThMA of the Zeo-Karb H influent is higher. Improvement results from recycling a portion of the demineralized water to the inlet of the Zeo-Karb H unit. This recycled demineralized water dilutes the raw influent and reduces the ThMA of the water actually passing through the Zeo-Karb H unit, thus appreciably improving effluent quality.

CO_2 Removal

Furthermore, less acid is required per thousand grains of cations removed when treating waters containing lower ThMA. Therefore, by continuous recycling, an appreciable saving is made in the amount of acid required per 1000 gal of treated water.

During the past year, a number of demineralizing installations have been made in which CO_2 is removed by cold-water vacuum deaerators instead of the usual forced-draft degasifiers. With this system, the CO_2 can be readily reduced to 2 to 3 ppm and the dissolved oxygen to 0.1 and 0.2 ppm. Reduction of CO_2 and dissolved oxygen content to such low values makes it possible to eliminate expensive corrosion-resistant piping distribution.

Results in many installations indicate that the demineralizing process is a practical, economical method of producing both small and large quantities of water, virtually free of electrolytes. Except for impurities such as silica, which is of no importance for most process purposes, demineralized water is equal or superior to commercial distilled waters.

Units now in the U. S. can produce 35,000 gal of demineralized water per min. They are installed in a variety of industries that require high-quality low-dissolved-solids water.

For Dependable Delivery & Quality

Pre-Fabrication & Piping Installation

call on SHAW

The Pre-fabrication facilities of our Wilmington plant include equipment for performing every type of fabrication operation, including Heat Treatment and Non-Destructive Testing.

Your individual requirements are carefully interpreted by our Engineering Department, then accurately scheduled with regards to your delivery needs. Shaw Piping is processed under controls governing the quality and performance to accepted and proved standards.

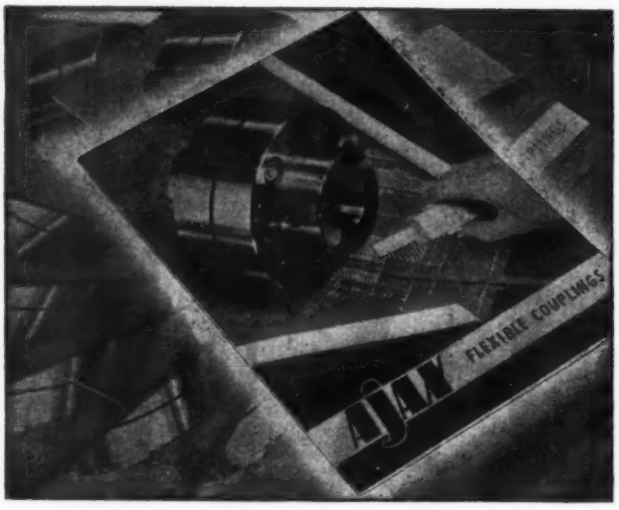
C. C. ZIMMERMAN
Chief Engineer

Since 1893

Benjamin F. Shaw Company

Second & Lombard Streets Wilmington 99, Delaware

Phone your nearest **AJAX** *Representative for this new catalog*



A NEW Ajax Flexible Coupling Catalog is just off the presses. It gives working data on all Ajax types including Standard, Mill Motor (Taper Bore), Shear Pin, Bolt-on, Brake Drum, and Detachable Hub Couplings.

ATLANTA, GA.
George E. Stinsman
Rhodes Haverty Bldg.

BOSTON, MASS.
George C. Ewing
10 High St.

BUFFALO, N. Y.
A. E. Jones Co.
L. F. Main
259 Delaware Ave.

CHICAGO, ILL.
R. G. Cady
37 W. Van Buren St.

CINCINNATI, O.
J. E. Stover
1005 American Bldg.

CLEVELAND, O.
L. V. Hooper
402 Swetland Bldg.

DALLAS, TEXAS
Raymond L. Tate
6530 Robin Road

DENVER, COL.
Urquhart Service
16th St. at Blake

DETROIT, MICH.
Ralph J. Hutchinson
2842 W. Grand Blvd.

INDIANAPOLIS, IND.
A. R. Young
635 No. Penna. St.

LOS ANGELES, CALIF.
Howard Speddy
2892 W. 7th St.

LOUISVILLE, KY.
Alfred Halliday
330 Starks Bldg.

MILWAUKEE, WIS.
Roloff Engineering Co.
610 W. Michigan St.

MINNEAPOLIS, MINN.
R. J. S. Carter
1219 Flour Exchange Bldg.

NEW YORK CITY
W. Richard Witte & Co.
220 Broadway

PHILADELPHIA, PA.
V. L. Sanderson
1710 Walnut St.

PITTSBURGH, PA.
J. Guy Griffith
1251 Union Trust Bldg.

RICHMOND, VA.
F. K. Howell Co.
American Building

ST. LOUIS, MO.
R. L. Johnstone
1319 Waldron Ave.

SAN FRANCISCO, CALIF.
J. J. Brady Co.
71 Front St.

SYRACUSE, N. Y.
Arthur E. Jones Co.
603 Herald Bldg.

WILMINGTON, DEL.
Wm. Bradford
1211 Gilpin Ave.

CANADA

PEACOCK BROTHERS, LTD.
P. O. Box 6070
Montreal, P. Q.

CALGARY, ALBERTA
215 10th Ave. W.

SYDNEY, NOVA SCOTIA
P. O. Box 210

TORONTO, ONTARIO
510 Federal Bldg.

VANCOUVER, B. C.
Pacific Coast Fire Bldg.

WINNIPEG, MAN.
W. W. Hicks & Co.
567 Banning St.

Patents Make Jobs

PATENTS MAKE JOBS

AJAX FLEXIBLE COUPLING CO. INC.

Incorporated 1920 **WESTFIELD, N. Y.**

Surface Condenser

(*Continued from page 74*)

since nothing in the quality of the water dictated larger, less-efficient tube diameter.

Tests indicated an average operating cleanliness ratio of 0.85. Existing condensers operate with 6-ft-per-sec water velocity without erosion trouble. Because of the good-quality water, it was decided to use 7.5-ft-per-sec velocity for the new unit. Pumping costs were relatively high and two-pass design was tentatively selected.

Interpolating between the capacity figures, 7200 kw corresponds to 27.45 in. Hg vacuum. From the turbine-characteristic equations (8) and (9), net heat rejected to the condenser is 965 Btu per lb or 73.4 million Btu per hr.

From Fig. 2, at 7.5-ft-per-sec velocity, inlet-water temperature of 73 F and cleanliness ratio of 0.85, heat-transfer rate $U = 740 \times 1.015 \times 0.85 = 638$ Btu per hr per sq ft per degree F. With a velocity of 7.5 ft per sec and 15-ft tubes in a two-pass design, from Fig. 3, $k = 1.32$.

Fig. 4 is then entered with a value of $U/k = 638 \div 1.32 = 484$, inlet-water temperature 73 F, vacuum 27.45 in. Hg ($T_s = 109.5$ F) and heat rejection 73.4 million Btu per hr. The resulting value for circulating-water flow is 6400 gpm. Surface is $6400 \div 1.32 = 4850$ sq ft.

This solution pertains only to the maximum-load limitation as determined by system requirements. Economic analysis of annual operating costs should, of course, be undertaken with average, instead of maximum, water temperature.

One can rapidly make any number of similar calculations and apply the methods of economic evaluation to the results. For instance, if it is desired to compare a single-pass condenser having the same size and length of tubes which would produce the same vacuum, from Fig. 3 k is 2.64, U/k is 242 and from Fig. 4 the required water flow is found to be 10,300 gpm and surface 3900 sq ft.

Naturally a smaller condenser with a greater flow of water results than for two-pass design. A comparison of cost of the two alternates including pumps and intakes (and pump power) indicates the more economical choice.

In conclusion, the writer expresses appreciation to J A Powell, chief mechanical engineer of Stone & Webster Engineering Corp for suggestions and encouragement in preparation of this article.

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

Users find many ways to save with Standard

Using costly lubricants where ordinary lubricants are good enough is like pouring money down a rat hole.

Expensive lubricants are protected against waste.

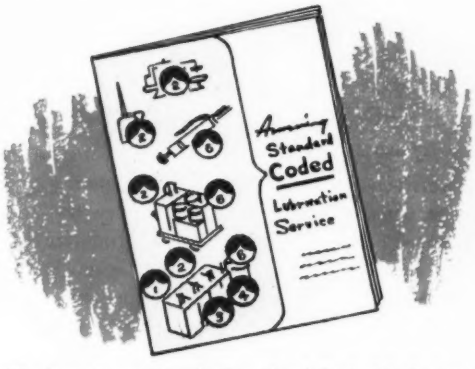
The *right use* of lubricants is of as much interest to us, the supplier, as it is to you, the user. That is why this simple method of getting the *right* lubricant in all the *right* places—Standard Coded Lubrication Service—is offered to all companies in the Middle West served by Standard Oil Company (Indiana).

1 CODED 2 LUBRICATION

A central state plant superintendent says, "Your Coded Lubrication Service solved one of my biggest headaches. We use many types of lubricants. Some are rather special and costly. With your system I am more certain that these special products are used where they should be and *not* used by mistake where ordinary lubricants are good enough."

This plant man gets a two-way saving. Expensive equipment is protected against breakdowns caused by the use of the wrong lubricant.

Send for this booklet



Find out how simple Standard Coded Lubrication Service is to install and keep up. A Standard Oil Lubrication Engineer will be glad to discuss its application with those in charge of lubrication in *your* plant. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for a copy of the booklet or the Lubrication Engineer nearest you.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

How to cut lubricant leakage and throw-off . . . safely!!

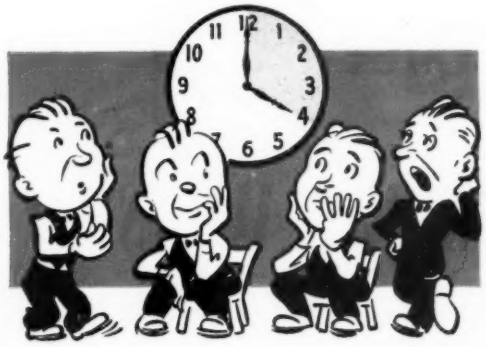
THE PROBLEM of oil leakage from bearings or gear cases, or oil throw-off from rapidly moving parts such as chains or open gears, recurs regularly in practically every plant. The cure is sometimes very simple, such as installing new seals on bearings or gear cases, or using a heavier grade of oil.

But the problem can be complicated, for example, when parts are hard to get, when shut downs to make repairs on machines are out of the question, or where heavier grades of lubricants do not give proper lubrication. In these cases, Stanodrip has solved the problem for many manufacturers.

Excessively heavy lubricants, while they may stop leakage, usually result in overheating, particularly on high speed bearings. Or they may not circulate in gear cases, thus providing little or no lubrication. Stanodrip stops leakage where a regular oil of approximately the same grade will not. Stanodrip contains special additives which resist the tendency to drip or creep, but do not impair its lubricating quality. Let a Standard Oil Lubrication Engineer help you apply Stanodrip to eliminate unsightly, oil consuming, lubricating jobs in your plant. He will be glad to make a test of Stanodrip with you.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

How Stanodrip saves lubricant, maintenance, and production time



Saves 4 hours time of 4 operators each month. In a St. Louis plant every clutch failure on a bomb-nosing machine tied up the machine for four hours, losing the time of four operators and costing $80 for replacements. In spite of the fact that a number of lubricants were tried, clutch faces had to be replaced at least twice a month on each of the three machines. It was about decided that there was no way out of the predicament. Then a Standard Lubrication Engineer suggested a test of Stanodrip because of its ability to stay on the plates and reduce wear. As proof that it did, there have been no clutch failures on the three machines in the first two months' operation.

Saves half the lubricant and all of the cutting oil. Dilution of the cutting oil by the bearing lubricant on a battery of old screw machines in a Michigan plant made it necessary to change many batches of cutting oil long before they were used up. When the straight mineral oil that was used on the bearings was replaced by Stanodrip, lubricant consumption was cut in half and cutting oil dilution practically eliminated.

Stanodrip

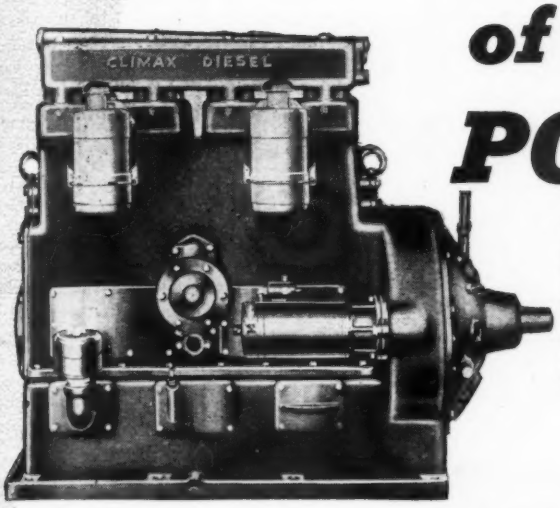
Buy more War Bonds

STANDARD OIL COMPANY (INDIANA)

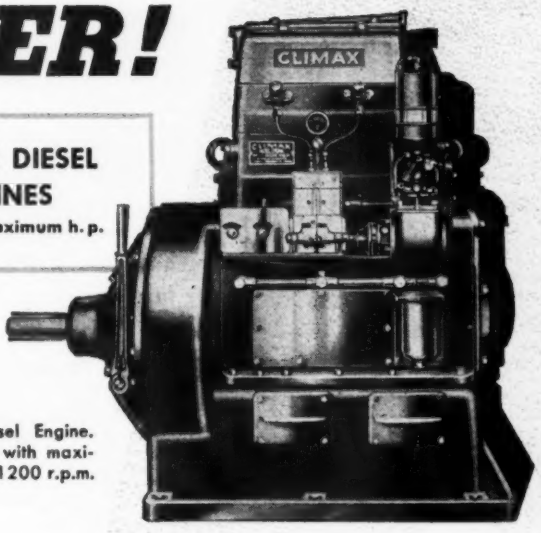
STANDARD SERVICE

★ LUBRICATION ENGINEERING

LITTLE GIANTS of Diesel POWER!



CLIMAX DIESEL ENGINES
22 and 44 maximum h. p.



CLIMAX MODEL D297 Diesel Engine. Four cylinder, full Diesel, maximum rating 44 h.p. at 1200 r.p.m. Also available with speed reduction units.

CLIMAX MODEL D148 Diesel Engine. Two cylinder, full Diesel with maximum rating of 22 h.p. at 1200 r.p.m.

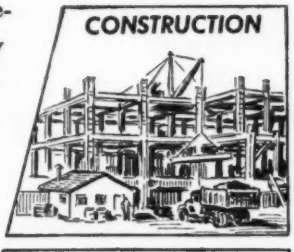
WHEREVER a compact, space-saving source of dependable, economical power is required, these small Climax Diesel Engines are to be found doing *yeoman* service—driving fans and blowers, pumps, compressors, conveyors and hoists, small locomotives and power saws, powering boats, supplying auxiliary mechanical power on large vessels.

These smooth-running Climax Diesels—strongly built with one-piece construction of cylinders and crankcase—consume only cheap, low grade, standard fuel oil. They are 4-stroke-cycle type, solid injection, compression ignition engines that start at the touch of a button, by local or remote control. Dependable, quick starting, easy to operate, and safe.

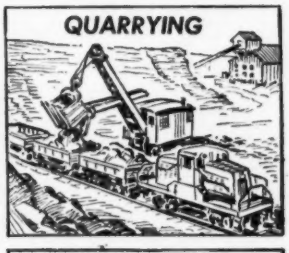
Standard equipment includes American Bosch fuel pump and injection nozzles, positive lubrication and cooling and electric starting equipment. For complete information and specification bulletin, write Climax Engineering Company, Clinton, Iowa.

MARINE

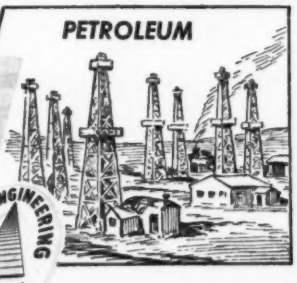
CONSTRUCTION



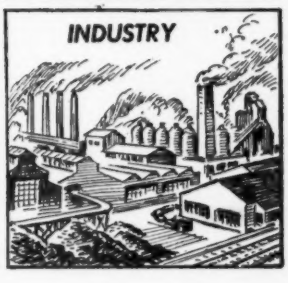
QUARRYING



PETROLEUM



INDUSTRY



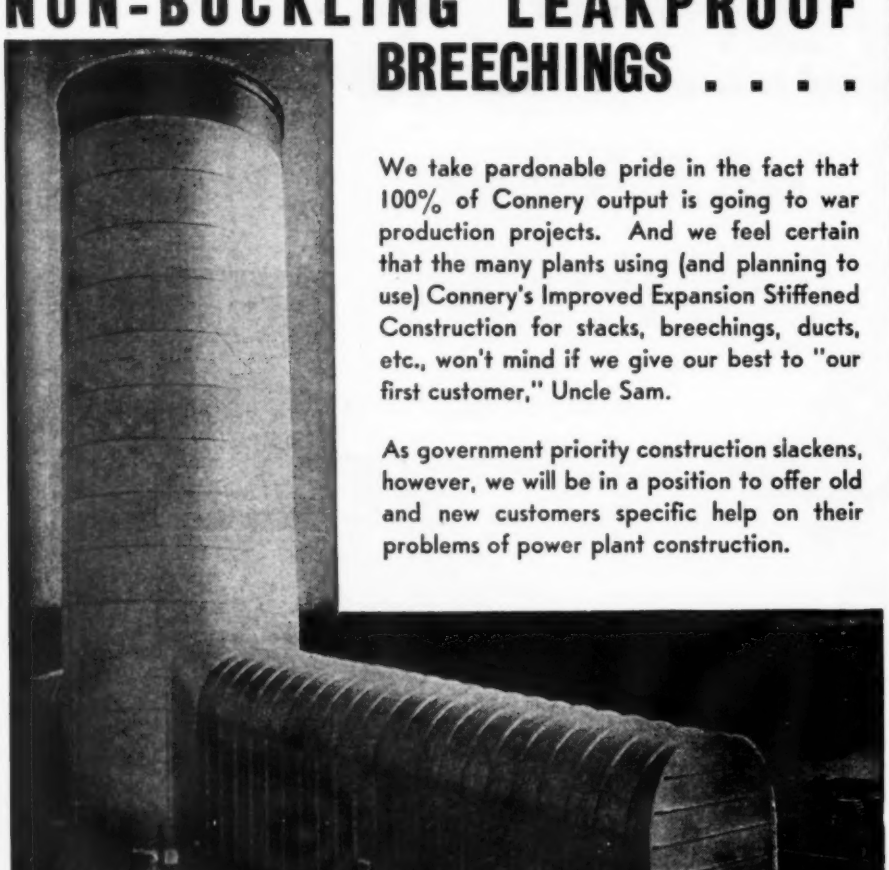
climax DIESEL

CLIMAX ENGINEERING COMPANY

POWER, LIGHT and STANDBY SERVICE

For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .



We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.

STACKS
•
BREECHINGS
•
UPTAKES
•
HOPPERS
•
AIR DUCTS

RECENT INSTALLATIONS

NEW HAMPSHIRE GAS & ELECTRIC CO.	PORTSMOUTH, N. H.
UNITED ILLUMINATING CO.	BRIDGEPORT, CONN.
ROCHESTER GAS AND ELECTRIC CO.	ROCHESTER, N. Y.
INDIANAPOLIS POWER & LIGHT CO.	INDIANAPOLIS, IND.
CONSOLIDATED GAS ELEC. LIGHT & PR. CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
U. S. NAVAL TRAINING STATION	GREAT LAKES, ILL.
HENRY DISSTON SONS	PHILADELPHIA, PA.
QUARTERMASTER DEPOT	PHILADELPHIA, PA.

CONNERY CONSTRUCTION CO.

Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

New Equipment

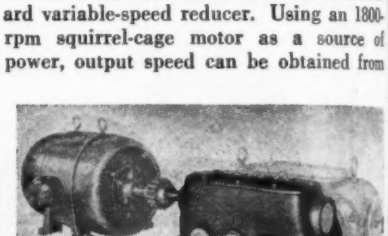
(*Continued from page* 126)

within a wide range. Feed rate remains practically constant regardless of oil level. Construction is sturdy, consisting of two main parts—the base and reservoir. Base is made of brass and reservoir is of unbreakable transparent plastic. Visible oil supply indicates when a refill is needed. A self-closing hinge lid on top of reservoir, which can be opened with an oil-can spout, makes filling easy. Oiler can be taken apart for cleaning by unscrewing reservoir from base.

It is available in four body sizes. Standard capacities are $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ and 1 oz, having $\frac{1}{8}$- or $\frac{1}{4}$-in. pipe thread. *Oil-Rite Corp*, 3478 *S 13th St, Milwaukee 7, Wis.*

Variable-Speed Drive

DIFFERENTIAL VARIABLE-SPEED DRIVE consists of two mechanical differentials and a standard variable-speed reducer. Using an 1800-rpm squirrel-cage motor as a source of power, output speed can be obtained from



0 to 800 rpm in one direction, or from 400 rpm forward through 0 to 400 rpm reverse. Torque remains constant throughout entire range.

Unit shown is No. T3. It is made by utilizing Link Belt PIV No. 3 and two mechanical differentials. Torque capacity of this unit is 750 in. lb throughout entire range. Other units of the line may be supplied to provide up to 2100 in. lb torque through same speed ranges. Smaller units are also available.

Output shaft can be made to duplicate any movement of control shaft by a control box furnished with unit. Control shaft may be operated with but a few in. lb torque while output shaft will deliver full power of the unit. Many variations of the basic unit may be supplied for specific applications. *Ohio Gear Co*, 1330 *E 179th St, Cleveland, Ohio.*

Magnetic Strainer

FOR LUBRICATING OIL LINES of steam turbines, or other power equipment, Model 200-MS-1 Winslow *Duplex* strainer combines in one unit bypass valves, pressure regulator, main control valve and two strainer elements in which powerful magnets are located to remove filings and metal particles through combination of magnetic action and screening. Quick-acting hand-operated 3-way control valve permits flow change from one strainer element to the other, or through both elements. Flow-control valve has been greatly simplified

For Strength, Safety and Extra Service on High Pressure Pipe Lines...

THE MARK
OF PROVEN QUALITY

SOCKET WELDING TYPE
For Schedule 40—Schedule 80—Schedule 160 and Double Extra Heavy Pipe
SCREW END TYPE
For 2000, 3000, and 6000 Pound Service

Above are illustrated but a few of the W-S line of Forged Steel Fittings

or construction and maintenance work in power plants, oil fields, refineries, chemical plants, ship construction, air conditioning and refrigeration where uninterrupted high pressure, high temperature service is vital, Watson-Stillman Forged Steel Fittings are used for their greater strength and safety, exceptionally long-time service, due to strong, trouble-free joints. Machined from solid drop forgings. The Double-Diamond trade mark is your guarantee of *Proven Quality*.

SOCKET WELDING FITTINGS

Deeper sockets eliminate necessity of cutting pipe to exact lengths, speed up and simplify installation, furnish support for the pipe and provide self-alignment. No special fixtures are needed for lining up and holding joints. PROVEN WELDABILITY. Sizes . . . ⅛" through 4" I.P.S.

FORGED STEEL SCREWED FITTINGS

Long threads, accurately cut, perfectly aligned, for quick, easy installation. Uniform wall thickness throughout assures a higher factor of safety. Long low bands extend beyond last thread to insure extra strength and better wrench grip. Sizes . . . ⅛" through 4" I.P.S.

Send For These Bulletins

A-3—Factual data, drawings, pressure ratings, dimensions, tables, etc., on Forged Steel Fittings.

A-4—Description, specifications and drawings of bronze or forged steel Globe, Check, Needle and Angle Valves.

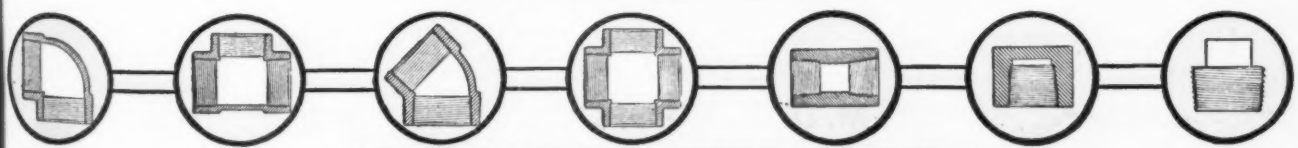
710-A—Hydraulic Jacks in independent pump and attached pump types; 10-500 ton capacities.

240-A—Hand Pumps for operating jacks, small hydraulic tools and for general hydrostatic testing. Single and double plunger types.

A-6—Shears for cutting wire rope and iron bars and rods; hand and hydraulic types.

A-7—Portable Pipe Benders; open-jaw type with built-in pumping unit and hydraulic cylinder. Will bend extra heavy steel pipe up to 2" and standard weight pipe up to 3".

Sold Through Leading Distributors



WATSON-STILLMAN

Distributor Products Division—Roselle, N.J.

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

7745

These are The Parts That Distinguish DARTS

TWO BRONZE SEATS GROUND TO A TRUE BALL JOINT

This feature distinguishes the Dart Union from all others—it has two bronze seats, which are perfectly ground to form a true-ball joint. It will stay put—leakproof—indefinitely; yet may be uncoupled instantly whenever you have a new job for it. Body and nut—made of high-test air-refined malleable iron—are practically unbreakable. In length of trouble-free service, Darts cost less. Order from your supplier.

E. M. DART MFG. CO.
PROVIDENCE, RHODE ISLAND

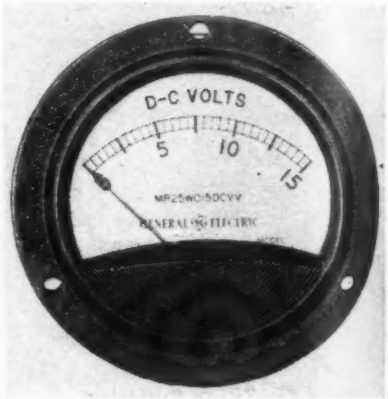
DART UNIONS

DART UNIONS LIVE LONGER

and requires no jacks to lock it in place. Adjacent to this 3-way valve is the pressure-regulating valve, for adjustment of outgoing oil pressure.

Model 200-MS-1 strainer is of either cast bronze or iron for the one-piece body which incorporates the manifold, strainers, inlet and outlet connections. Two cylindrical baskets are constructed around a main body of perforated steel, within which are fine wire-mesh linings. Magnets are suspended within baskets.

In the body is located a spring-loaded bypass valve that may be adjusted from the outside. Model 200-MS-1 is designed to handle 15 gpm. A larger model to handle 40 gpm is also available. Where finer filtration of lubricating oil is necessary, Winslow cartridge oil conditioners may be used with the strainer. *Winslow Engrg Co, Oakland, Calif.*



Panel Instruments

LINE OF 2½-IN. HERMETICALLY SEALED panel instruments, housed in steel cases and immune from effects of humidity, moisture, chemical fumes and other harmful agents, are for dc voltmeters and ammeters and for ac radio-frequency ammeters. They can be furnished in all standard ratings mentioned in, and conform to performance requirements of, *American War Standard ASA Specification C*-39.2-1944.

Made for flush mounting on nonmagnetic or steel panels, these new instruments incorporate the standard 2½-in. internal-pivot element in a steel case that shields them from stray magnetic fields. They are capable of withstanding a thermo-shock test of at least ten alternate exposures in salt water at 85 C and then at zero C, according to maker, without evidence of moisture penetration or damage to finish or inclosure. *General Electric Co, Schenectady 5, N. Y.*

File Cleaner

HARGRAVE FILE CLEANER with chip plow, according to maker, quickly and efficiently cleans a file of soft metal chips, such as lead, copper, aluminum and soft steel. A special square-shaped plate is fastened to frame of file cleaner. This plate or plow, made of soft steel, is used by striking one edge on the file to be cleaned, thus impressing the tooth pattern on the edge. Plow is then pushed parallel to file grooves. It plows out imbedded chips and dirt. When a file

Dearborn Engineer does this for you . . .

1 Studies your water and plant operating conditions.
2 Sends samples of your water to main laboratory for analysis.
3 Recommends proper chemical treatment and chemical control methods.
4 Supervises installation of feeding equipment.
5 Instructs your men on water test methods for treatment dosage adjustment and blowdown control.
6 Calls regularly to insure maintenance of recommended conditions.

The Dearborn Engineer in your vicinity is a versatile individual. He knows local water characteristics . . . he has a wide knowledge of plant operating conditions.

When you call him in to investigate troublesome boiler water, he gets to work . . . right in the boiler room. Takes a sample from the feedwater supply, gives it an "on the spot" test, and makes initial corrective recommendations to carry over the emergency.

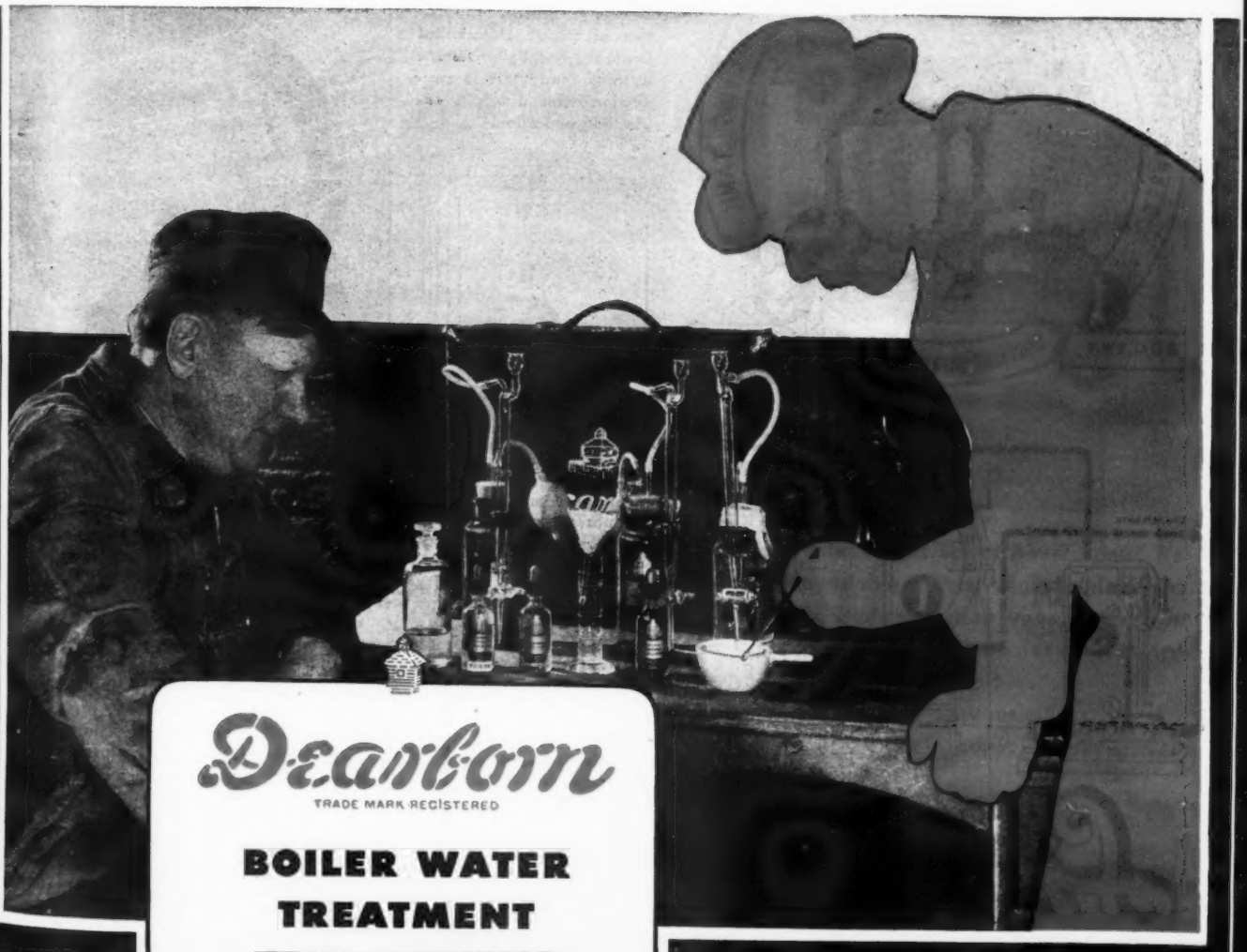
Then water samples are forwarded to the Dearborn laboratories where further analysis is made, and scientific counteracting treatment is prepared to neutralize the harmful tendencies.

Your local Dearborn Service Engineer then goes back in your boiler room to inaugurate the corrective measures, make periodic check-ups, and work with your men to keep boilers in full steaming capacity. Call him. He will serve you promptly and well.

DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave.
Chicago 4, Illinois

Dearborn Engineer serves you...

WITH HIS HANDS AS WELL AS HIS HEAD



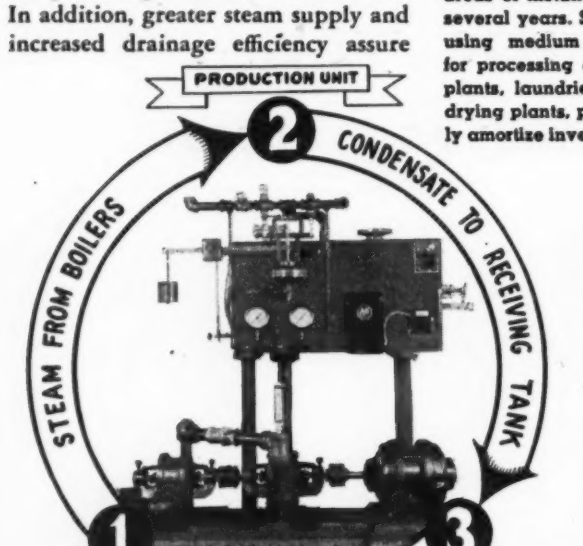
Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE

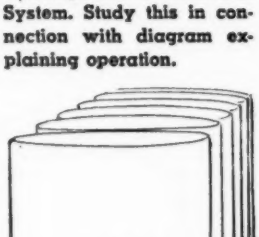
Temporary Fuel Rationing: PERMANENT FUEL SAVING

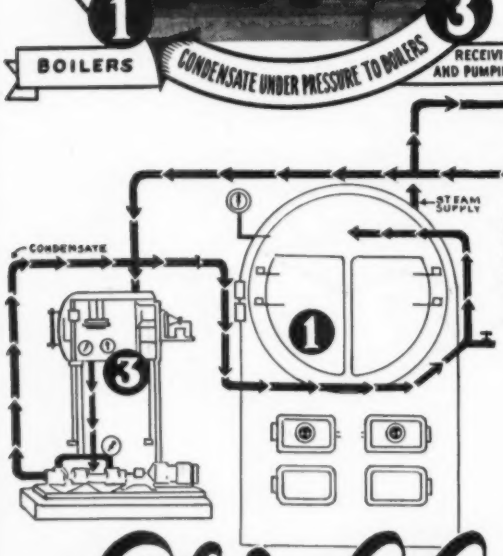
Year-in-year-out fuel conservation—for you, a program of self-rationing that becomes a permanent program of fuel *saving* of up to 20 per cent—is possible with Stickle Differential Drainage and Boiler Return System. But this Stickle System allows fuel conservation without interfering with production. Instead of reducing production, production may be increased. Boiler capacity is increased in ratio to the percentage decrease in fuel used. In addition, greater steam supply and increased drainage efficiency assure performance of production units at maximum capacity; and the elimination of high velocities and reduction of scale—further important results—decrease maintenance costs on boilers, traps, valves, etc.

Stickle Differential Drainage and Boiler Return System is a closed pumping system that returns condensate to boilers at a temperature only a few degrees below the temperature of steam at operating pressures. It has fully demonstrated its advantages in hundreds of installations made during the past several years. Savings effected in industries using medium and high pressure steam for processing operations, such as canning plants, laundries, milk drying plants, sand drying plants, paper board mills, etc., quickly amortize investment.



Below, a specific application of Stickle Differential Drainage and Boiler Return System. Study this in connection with diagram explaining operation.





Minimum results obtainable in any installation can be computed in advance—and guaranteed. Installation made without interfering with operation. For more complete information, ask for Bulletin No. 250.

OTHER STICKLE EQUIPMENT

Stickle Steam Traps—In series designs and sizes to meet specific operating conditions. Ask for Bulletins Nos. 115, 315, 415 and 515.

Stickle Regulating and Reducing Valves—Two series designs in small to large sizes. Ask for Bulletins Nos. 235 and 435.

Stickle Open Coil Feed Water Heaters and Purifiers—Deaerating and Non-deaerating types. Small to large capacities. Ask for Bulletin No. 117.

Stickle

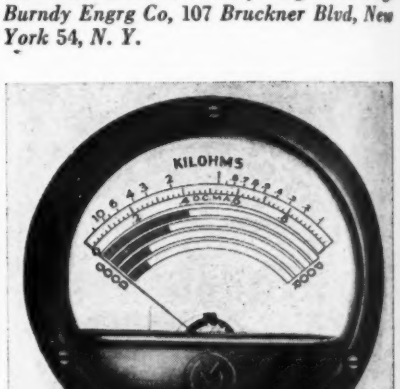
STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

of different tooth spacing is to be cleaned, a new edge of the plate is used. Plates are long lasting and when worn may be replaced at low cost. When nonmetallic dirt is to be removed, regular file card with its tempered steel wire teeth is utilized. *Cincinnati Tool Co*, 4093 *Montgomery Rd, Cincinnati* 12, *Ohio.*

Hand Tool

HYTOOL MY28, a lightweight universal hand tool, is for installing both copper and aluminum *Hydent* electrical connectors on large cables. Unusual features include: (1) It may be used on connectors for aircraft cable, sizes No. 8 to 4/0; U. S. Navy cable, sizes No. 23 to 250 mcm; commercial cable, sizes No. 8 to 250 mcm; flexible, extra flexible and welding cable, sizes No. 8 to 4/0. (2) Single, stepped impression die makes tool entirely self-contained. (3) Adjustable holding die accommodates entire range of connectors for which *Hytool* is designed. (4) It has high mechanical advantages. (5) Device weighs 6½ lb. High-strength steel construction makes tool light enough to be easily handled, yet strong enough to withstand the tremendous force developed and resist shocks caused by rough handling. *Burndy Engrg Co*, 107 *Bruckner Blvd, New York* 54, *N. Y.*



Indicating Instruments

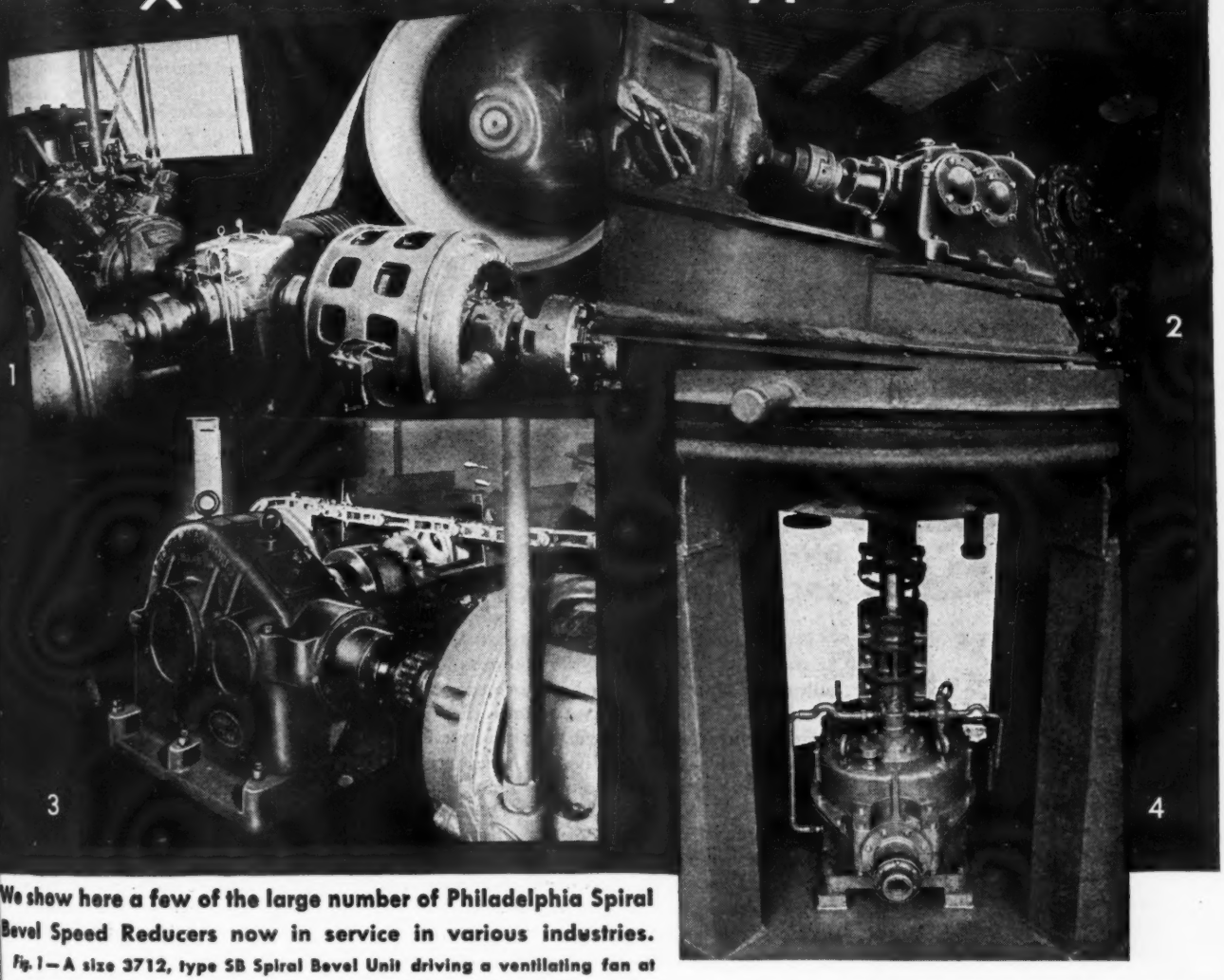
POSITIVE HERMETIC SEALING has been effected with a minimum number of seals by building 2½- and 3½-in. meters into a protective cuplike frame and then sealing glass cover to metal rim. There are no rubber gaskets or cement seals. Tests prove effectiveness of new sealing, according to maker, under severe tropical and/or freezing conditions.

Window-sealing process was developed and perfected in cooperation with engineers of the Corning Glass Co. Windows, of double-thickness tempered glass, processed for solder sealing, are highly resistant to shock. Completely dehydrated, the instruments are filled with dry air at sea-level pressure. Newly designed crowned crystal is said to permit greater scale length, reduce shadows and make for better visibility. Magnetic shielding makes possible interchangeability on any panel without affecting calibration. For extra RF shielding, instrument can be supplied silver plated.

Silver-clad beryllium-copper hair springs reduce zero shift at all temperatures. Other features are standard *Kovar* glass-bead

Philadelphia
SPIRAL-BEVEL SPEED REDUCERS

...the right choice for many types of drives



We show here a few of the large number of Philadelphia Spiral Bevel Speed Reducers now in service in various industries.

Fig. 1—A size 3712, type SB Spiral Bevel Unit driving a ventilating fan at a coal mine. Ratio 1 to 1, 100 H. P. at 400 R. P. M. A double input shaft is connected with an engine for standby service.

Fig. 2—Size 3609, type BLX Spiral Bevel Helical Reducer driving a conveyor. Ratio 57.7 to 1. Rated 9.5 H. P. at 870 R. P. M.

Fig. 3—On a deck in the Ohio River, this size 3508, type BLT Spiral Bevel Helical Unit drives flight conveyors. 32 H. P. at 850 R. P. M.; ratio 10 to 1.

Fig. 4—View of base of Vissolier, showing mounting of size 3509, type UBH reducer. This unit is driven by a 30 H. P. 1800 R. P. M. motor (not shown).

Investigate Philadelphia Spiral Bevel Speed Reducers for dependable, efficient right angle drives. Single, Double, Triple reduction types. Ratios from 1.5 to 1 up to 238 to 1. For horizontal or vertical service. Our Bulletin 200 gives complete information. Write on your business letterhead for a copy.

ARMY E NAVY

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

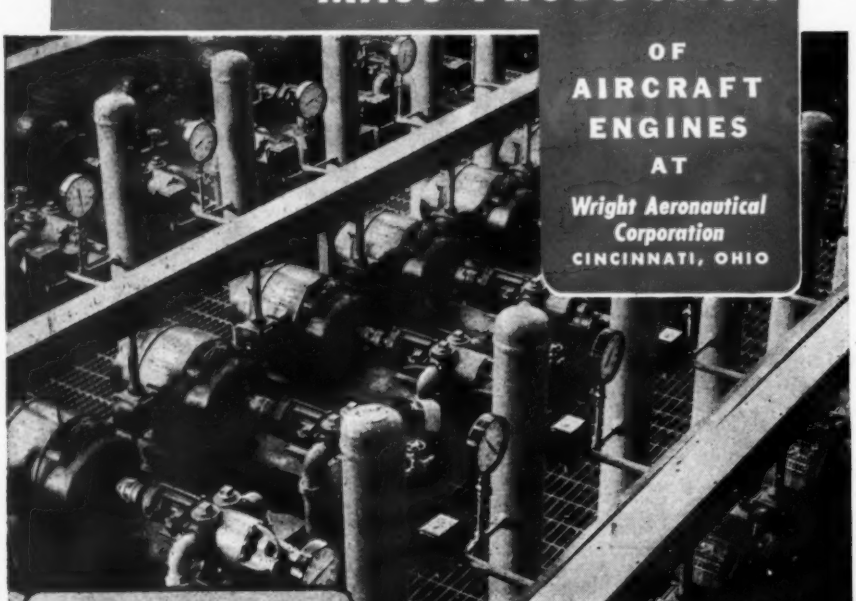
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

HOW A MODERN PUMPING STATION FACILITATES MASS PRODUCTION

OF AIRCRAFT ENGINES AT

Wright Aeronautical Corporation

CINCINNATI, OHIO



JOB FACTS

Roper Series F pumps used on job, each engineered to handle a variety of cutting oils. Rated capacity 20 g.p.m. with relief valve set at 150 lbs. All are mounted on individual bed plates with 3 H. P., 1750 r.p.m. motors controlled by pressure switches. Pumps can be disassembled — gears, cams and bearings inspected or replaced — without disturbing pipe connections or mounting.

FREE ENGINEERING SERVICE

A staff of competent, experienced Roper engineers are ready and willing to help you solve your pumping problems. There is no obligation. Simply send us details of your problems, or get in touch with Roper field engineers located in principal cities. Ask for free catalog, also booklet, "How To Solve Pumping Problems".

BIG BANK OF ROPER PUMPS SPEED HANDLING OF OILS

This big bank of Roper pumps at Wright Aeronautical Corporation, move thousands of gallons of cutting oils to huge machine tool batteries. Through delivery lines that run from a central station directly to the scene of operation, they quickly dispatch a variety of oils to serve production requirements.

This modern facility of a modern production plant saves time and manpower . . . eliminates inter-plant delays and inconveniences associated with transporting large quantities of oils. It's a pump job engineered by Roper in collaboration with plant engineers to help maintain speedy production of vital aircraft engines. Perhaps Roper can also help you in working out a solution to your problems. Call on experienced Roper service engineers, located in principal cities, or write factory today.

GEO. D. ROPER CORPORATION

ROCKFORD, ILLINOIS

Write for Catalog No. 6-62

It illustrates and describes Roper design, construction, range of models, and how they may be adapted to fit individualized requirements.

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

ROPER Rotary Pumps

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES

terminals with solder lugs and special phosphate finish on case, which is claimed to meet a 200-hr salt-spray test.

Built to AWS standards, the meters are available in all dc ranges. Model HM2 is directly interchangeable with AWS Models MR24 and 25 and HM3 with AWS Models MR34 and 35. *Marion Electrical Instrument Co, Manchester, N. H.*

Rectifier Unit

COMPACT, LIGHTWEIGHT rectifier unit FTR-3128-S is for testing instruments, inverters, controls, aircraft-manufacture-and-maintenance, radio-navigational and communications equipment. It is also for numerous other applications where an easily portable, well-regulated dc power supply is required.

Unit utilizes the Federal selenium rectifier and operates from a single phase ac input of 115 v, 58 to 62 cycles, providing dc power up to 10 amp, continuous duty,

at any selected voltage between 22 and 30 v. Output voltage is automatically held constant within ±0.5 volt regardless of load variation from zero to 10 amp, or ac line-voltage fluctuations of 105 to 125 v. Ripple voltage is limited to about 5%. Unit maintains its performance with line frequency changes which exceed those of commercial power lines.

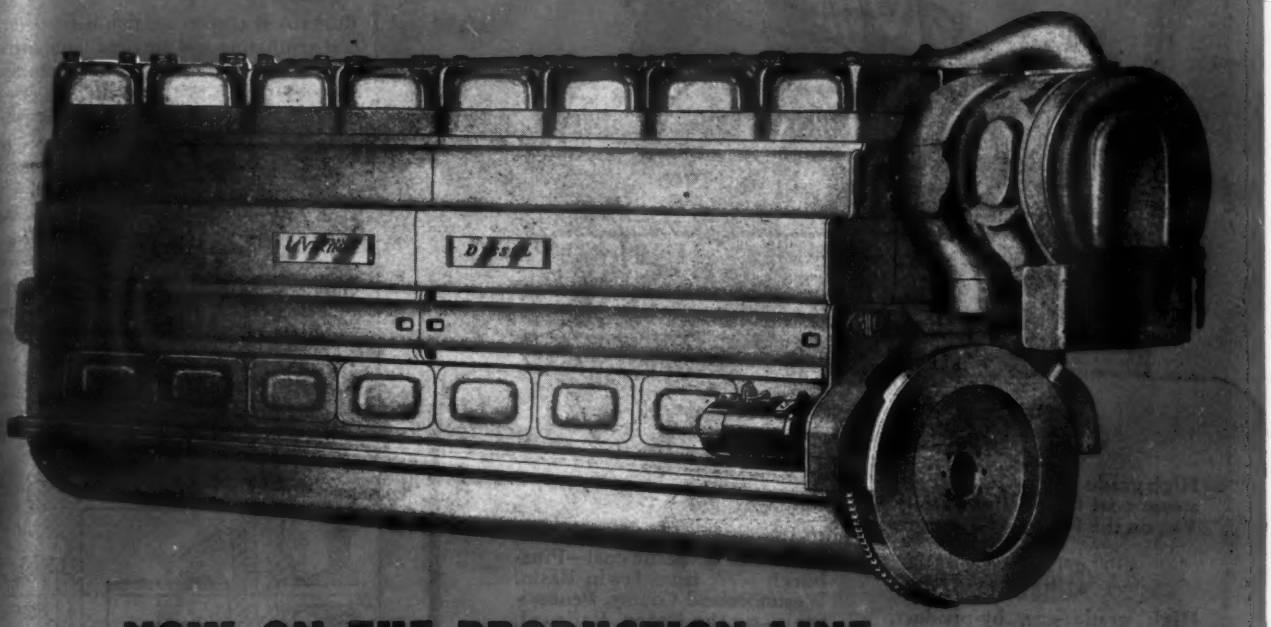
An on-off switch, 0-30-scale dc voltmeter and dc output terminals are mounted on front panel. An 8-ft rubber-covered cord with metal-sheathed plug is provided for ac input connection. Entire equipment is inclosed in a black medium-wrinkle finish cabinet. *Federal Telephone & Radio Corp, 32 Central Ave, Newark 1, N. J.*

Mercury Clutch

IN ITS SIMPLEST FORM, mercury clutch or coupling consists of a rotating drum-like member attached to power source, containing a small quantity of mercury. When this drum is in motion, centrifugal force, varying as the square of the speed, urges the mercury outward. Since the mercury is confined in a narrow annular space, a "head" or annular column is created.

This pressure acts directly on friction members and at the desired speed brings them into contact with a drum attached to load. Restraining springs, tending to counteract force of mercury, determine speed at which engagement is automatically obtained. As speed increases or diminishes

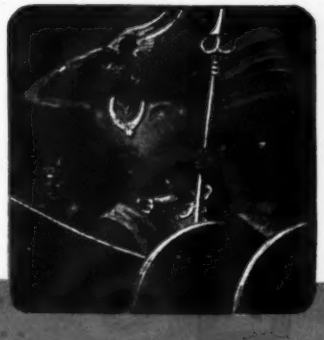
DIESELS *by Sterling*



NOW ON THE PRODUCTION LINE . . .

. . . WHEN DO YOU WANT YOURS?

★ So great has been the interest in the new Sterling Viking Diesel that we have already set up production line methods of manufacturing this advanced streamlined engine. This means we can accept orders now for early delivery of this modern improved power plant for operating electric generators, water pumps, draw bridges, dam sluices, shovels, bulldozers, snow plows and many other power applications. Sterling engineers will gladly cooperate in planning installations of the Sterling Viking Diesel best suited to your particular requirements—six or eight cylinder; supercharged or unsupercharged. Write for illustrated engineering bulletins.



Other Sterling engines—gasoline, gas, butane and Diesel, from 85 to 1800 horsepower—also available.

"KEEP BUYING WAR BONDS"

STERLING VIKING DIESEL

STERLING ENGINE COMPANY, 1271 NIAGARA ST., BUFFALO 13, N. Y. *Offices in New York, Washington and Chicago*

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX
STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal

Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

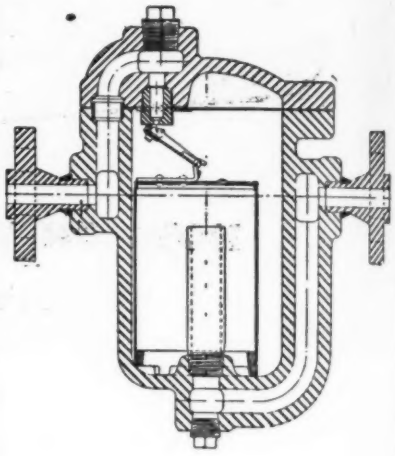
BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

following engagement, driving power of friction surface increases or diminishes.

Clutches are made in diameters of 4 and 4½ in. and a larger size will soon be available. They may be furnished in ranges suitable for most applications requiring moderate power ratings. *Mercury Clutch Corp, Canton, Ohio.*

Axial-Flow Fans

BUFFALO B LINE of axial-flow fans, for general ventilating and air-conditioning service, consist of belted or direct-connected models, in capacities up to 45,750 cfm and pressures ranging up to 1½ in. static. Fans come in *Vaneaxial* and *Tubeaxial* designs. Belted models are *Vaneaxial* only (with stationary directional vanes) direct-connected. Welded steel wheel has large hub and varying blade pitch to give uniform air flow over entire blade. Large hub prevents reentry losses. Housings are heavy-gage welded steel. Rigid motor supports permit use of standard motors. *Buffalo Forge Co, Buffalo, N. Y.*



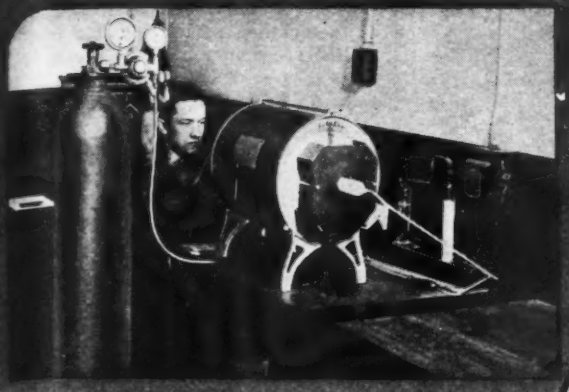
Steam Trap

DESIGNED FOR PRESSURES up to 600 psi, or where all steel fittings are desired, a new cast-steel inverted bucket steam trap with side-inlet, side-outlet pipe connections is available with ¼- ⅜- or 1-in. screwed or flanged connections. Flanges are welded into trap body. Height is 11¼ in.; dimensions between flanges range from 11¾ to 12⅛ in., depending upon pipe sizes.

Inverted bucket and valve lever are made of 18-8 stainless steel; valve and seat are chrome-steel hardened, ground and lapped. Trap cap and interior mechanism may be removed for inspection or repair without breaking either outlet or inlet connections. Cap and working parts are removed as a unit by unbolting the cap, leaving body intact on line. *Armstrong Machine Works, Three Rivers, Mich.*

Pressure Indicator

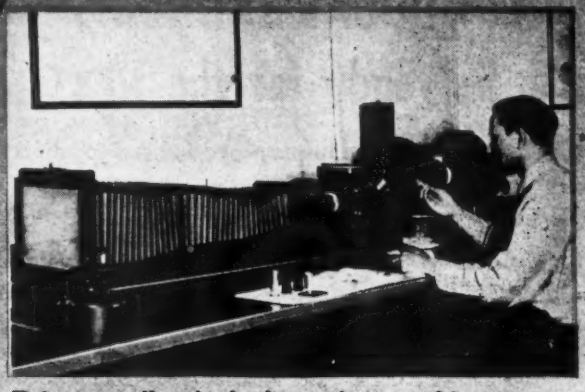
ELECTRONIC DEVICE indicates, in linear response on screen of a cathode-ray oscillograph, pressure-time curve of any internal-combustion engine, pump, airline or any other inclosed-pressure system where pressure measurements are desired. *Pressuregraph* measures either static or dynamic



Test for determining the amount of carbon in steel.

Determining the amount of essential elements from steel samples.

Rockwell testing machine for determining the hardness of metals.



Zeiss metallurgical photomicrographic apparatus capable of magnifying 2500 times.

With KELLOGG PIPING

Bugs are licked in the Laboratory before the Plant is Built!

Through super-sensitive apparatus measuring load deflections to one millionth of an inch, exact results are secured by The M. W. Kellogg Company in solving complicated design problems of high temperature and high pressure piping.

To assure selection of the correct steel, carbon or alloy pipe to meet varying operating conditions, Kellogg maintains a program of continuous research and tests. Chemists, metallurgists and process engineers work closely with the mechanical engineers. The result is a correctly designed and fabricated installation that will render long and satisfactory service.

On your next difficult piping job, consult KELLOGG.

KELLOGG

"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

LOS ANGELES: 609 SOUTH GRAND · HOUSTON 2, TEXAS: 402 ESPERSON BLDG. · TULSA: PHILTOWER BLDG.

AND . . . . IN *five* MINUTES

this DUGAS EXTINGUISHER will

be ready for the NEXT FIRE!

● You need never be unprepared for a second fire when DUGAS Fire Extinguishers are used . . . because you can *EASILY, QUICKLY* recharge them, on the spot.

As soon as one fire is killed, you have only to refill the chamber with PLUS-FIFTY DUGAS Dry Chemical, slip in a fresh cartridge, and IMMEDIATELY you're ready for the next, which might occur *ANYTIME.*

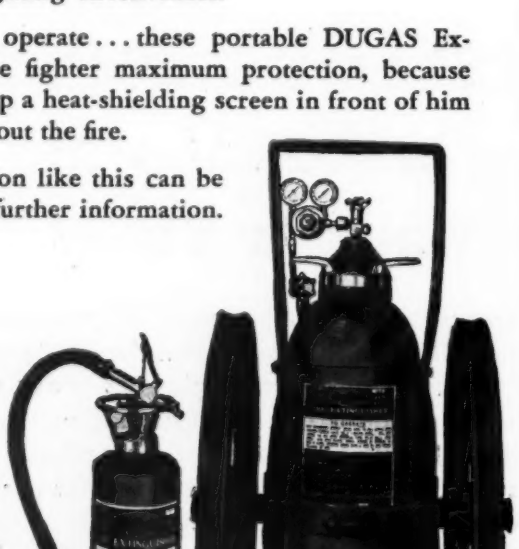
DUGAS Extinguishers require minimum maintenance, because they need no periodic recharge. In arctic cold or tropic heat, they retain their fire fighting effectiveness.

Easy to handle and operate . . . these portable DUGAS Extinguishers give the fire fighter maximum protection, because the dry chemical rolls up a heat-shielding screen in front of him as he moves in to snuff out the fire.

Constant fire protection like this can be yours. Write today for further information.

Approved by Underwriters' Laboratories, Factory Mutual Laboratories, and Governmental Agencies.

AN ANSUL PRODUCT
duGas
THE MASTER OF FLAME



DUGAS 15-T HAND EXTINGUISHER

DUGAS 150 WHEELED EXTINGUISHER

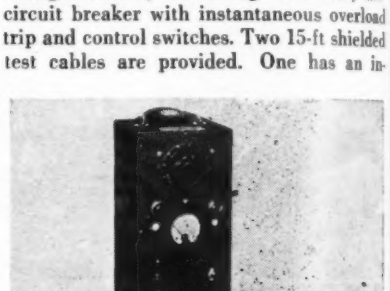
ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

pressures. It has been applied to 2-cycle engines to show pressure-time curve of main cylinder or crankcase.

In operation, pickup section is inserted in cylinder, chamber or airline, etc, to be pressure measured. Pickup response is transmitted, after amplification, to screen of a cathode-ray oscillograph. *Electro Products Laboratories, Inc, 549 W Randolph St, Chicago 6, Ill.*

Insulation Tester

SMALL PORTABLE insulation tester can be carried in one hand and plugged into any 115-v 60-cycle outlet. It supplies smooth variable-test potentials from 0 to 2500 v. Set has a capacity of 750 va and stands 1-min loads of 1500 va without injury. Complete set consists of a dry step-up transformer, variable autotransformer for smooth voltage control, indicating voltmeter, air-circuit breaker with instantaneous overload trip and control switches. Two 15-ft shielded test cables are provided. One has an in-



sulated test handle and the other a spring clip for grounding one side of high-voltage circuit. A 15-ft supply cord with a connecting plug and ground clip is supplied. Entire unit weighs only 47 lb, with case.

This equipment gives highly accurate indication of test voltage, as voltmeter is supplied from a separate coil on transformer winding. Set has several safety features such as the third conductor in supply cord which grounds the steel case, a red signal lamp, which remains lighted while set is energized, and shielded and grounded high-voltage test leads. *General Electric Co, Schenectady 5, N. Y.*

Smoke Stack

DURABILT STACK, built like a skyscraper, consists of a hexagonal steel structure, adequately braced throughout its length to resist high wind load, shock, lightning and earthquakes. Horizontal and vertical members are attached to structure and these support anchor and tile retaining castings. Each tile forming the inner wall is individually retained. Channels support outer tile at definite spacings. Any section of tile may be removed independently.

Insulation fits snugly and securely between tile and retainer castings, providing low radiation loss, and helps to keep temperatures within stack uniform, thereby improving draft.

Being sectionally supported, there is no cumulative load upon firebrick lining. Low foundation is required and weight saving of about 33⅓%, according to maker, are made possible. Outer casing of stack

THIS →

IS BETTER

PIPING PRACTICE

Than these Together

Why make three welds when two will produce a better piping job? Where it is necessary to change both the direction of flow and size of pipe, the Midwest Reducing Elbow replaces two welding fittings: (1) a standard elbow and (2) a reducer. The many important features are enumerated at the right.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows: unusual dimensional accuracy and uniformity, beneficial effect of working metal in compression, stress relieving, etc. Center-to-end dimensions are the same as in standard elbows with which they are interchangeable.

The Reducing Elbow is only one of the many Midwest developments designed to improve the quality of welded piping and to save cost in erection. Write for Bulletin WF-41 for complete information about the advantages of Midwest Welding Fittings.

MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

MIDWEST

REDUCING WELDING ELBOW

Eliminates One Weld
Cuts Installation Costs
Saves Time
Reduces Turbulence
Improves Appearance

MIDWEST

WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS

HERE'S HOW TO GET *Greater Flexibility* IN ALIGNMENT OF PIPE • VALVES FITTINGS!

The Westport Joint produces welds that are *sound* — fusion buttwelded joints that are made from one side only, with complete penetration to the root of the weld.

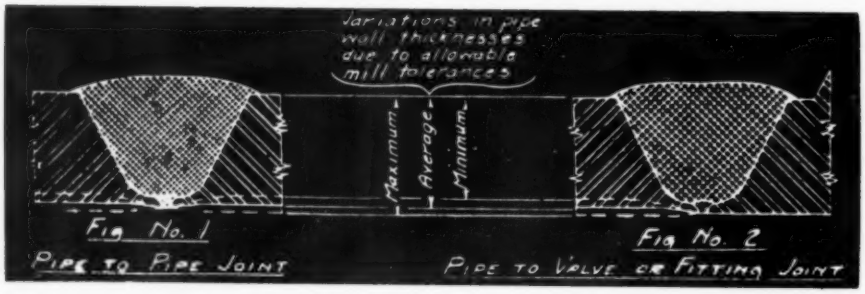
This provides greater flexibility in alignment of your pipe, valves and fittings, and is especially suitable in the welding of heavy wall piping for high pressure temperatures!

THE WESTPORT WELDED JOINT PROVIDES:

1. Greater Flexibility in alignment of pipe, valves and fittings
2. Complete penetration at the root of the weld
3. No constriction in pipe area due to Backing Rings
4. No sacrifice in strength of the pipe due to removal of wall or Backing Ring
5. Smooth pipe contour at base of weld with no "icicles" or protrusions
6. Meets A.S.M.E. Code requirements

ENGINEERS' NOTE

Do you have any piping problems we might be able to help you solve? All types of prefabricated piping jobs are today being done by W. K. Mitchell & Co. Years of piping research has taught us the solution to piping troubles. If we can be of help, please call on us. Our engineers are always at your service.



Illustrated above is the Westport Method . . . consisting of the use of a joint in which the ends to be welded are formed and machined to provide a special U-shaped groove . . . joining the lips at the root of the weld by the oxyacetylene process . . . and completing the joint by the usual electric arc procedure.

WRITE FOR BULLETIN AND DESCRIPTIVE LITERATURE

W. K. MITCHELL & CO., INC

PHILADELPHIA 46, PENNA.

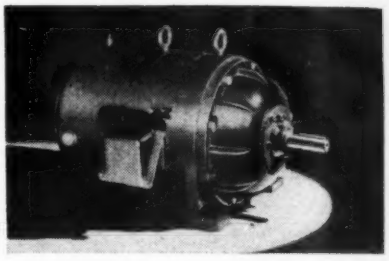
1899 1945

be of tile, sheet steel, transite or waterproof material. Air space is provided between insulation and outer tile throughout stack. Vents are located at bottom and top of stack.

Stack is easy to erect, repair and to apply safety railings and ladders. Crackproof stack may be erected in any height from 50 to 300 ft. *Chicago Fire Brick Co, 1467 Elston Ave, Chicago 22, Ill.*

Dual-Stream Nozzle

NEW DUAL-STREAM NOZZLE increases fire-fighting effectiveness of Dugas wheeled-model extinguishers. Nozzle permits operator to apply the dry chemical on a fire either as a long-range straight stream or as a shorter range fan stream. With this dual-stream nozzle, overhead fires, according to maker, can be extinguished successfully. *Dugas Div, Ansul Chemical Co, Marinette, Wis.*



Explosion-Proof Motor

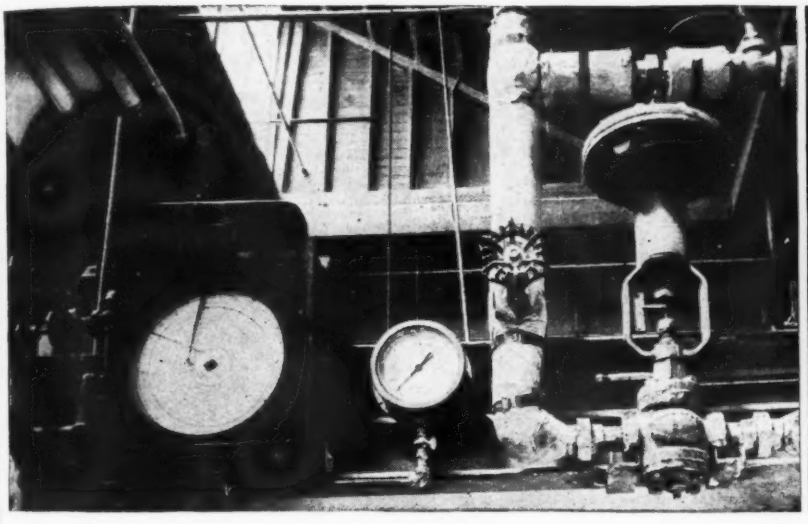
CLASS I, GROUP C, explosion-proof motor is for atmospheres containing ethyl-ether and similar vapors. Available in frame sizes 204-326, and in Types K (normal torque) and KG (high-starting torque) the motor is rated ½ hp at 600 rpm to 20 hp at 3600 rpm, 110, 208, 220/440, 550 v, 60, 50, 25 cycles. Construction is essentially the same as the Class I, Group D motors, but a special flamepath at shaft openings cools flame of internal explosions. Thermostats operate with a magnetic controller to disconnect motor at a predetermined temperature, but do not supplant regular overload relays.

Other features include a cast-iron stator, 4-position cast-iron conduit box and strong end shields of high-grade corrosion-resistant cast iron with reinforcing cooling ribs. Effective cooling is by a nonsparking fan and a convenient pressure-relief system provides for ease of lubrication without disassembly of motor. *General Electric Co, Schenectady 5, N. Y.*

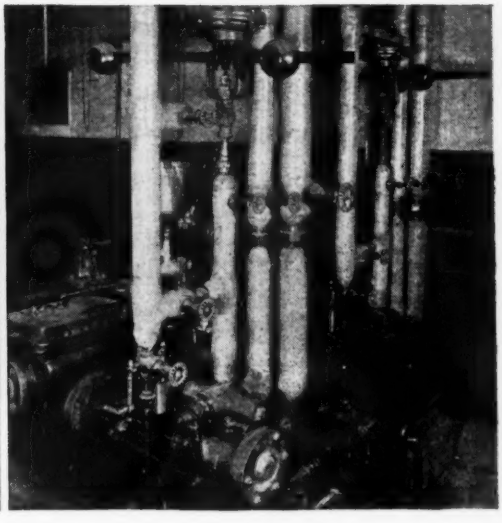
Heat Exchanger

IN THE HELIFLOW heat exchanger there are no inactive areas. All dead spaces are eliminated and constant velocity is maintained throughout path of flow around and through each coil. Unit may be designed for any velocity desired, regardless of how small the quantities of fluid to be handled. It is unnecessary to resort to close baffle spacing and small tubes, which make it difficult to clean either tube or shell side of conventional straight-tube exchanger. Usually, it is claimed, Heliflow shows a rate of heat transfer 40% higher than that ob-

How to Have *Trouble-Free* PRECISION CONTROL of every operation or process



★ One of the McAlear No. 110 Diaphragm Motor Valves controlling saturated steam pressure to wire rubber-processing machines in plant of leading manufacturer of wire and cable.

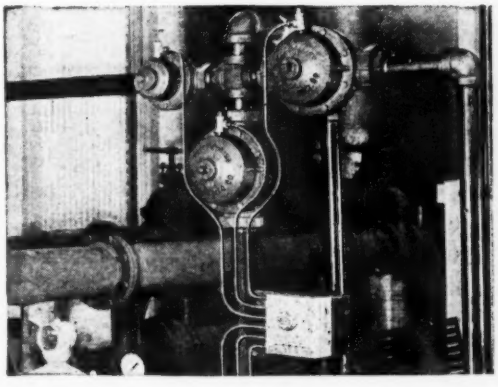


★ McAlear No. 455 Pump Governor regulating speed of steam vacuum pump on condensate return lines of large Government housing project.

EPENDABLE, long-life, high precision, low maintenance control instruments for more than 500 specific applications in power and process industries have been developed by McAlear.

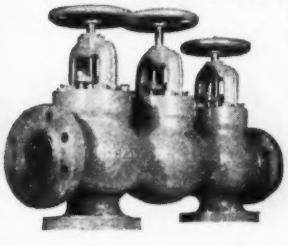
For *every* application that involves exacting control or regulation of temperature, flow, level or pressure of steam, water, air, gas, chemicals or oil—*McAlear either has the control you need*—or will develop it for you.

If *you* have a control problem call on McAlear engineers. Draw on their fund of experience . . . on their readiness and willingness to help you. For informative bulletins or catalog, write McAlear Manufacturing Company, 1913 S. Western Avenue, Chicago 8. *Affiliated with Hanlon-Waters, Tulsa, Oklahoma: Climax Engineering Company, Clinton, Iowa.*

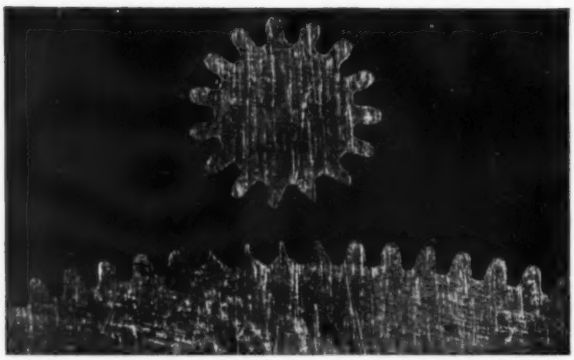


★ McAlear No. 1455 Pilot Operated Diaphragm Valves controlling flow of hard-to-handle liquid in processing operation.

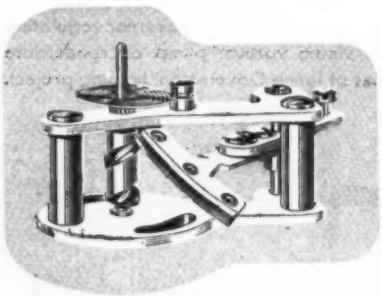
H-W TYPE 1800 Compact By-Pass Manifold simplifies piping designs, eliminates many flanged or screwed connections, saves space, reduces leakage hazards, without increasing installation costs. Sizes ½ to 4 inches. Bronze, cast iron, steel, screwed, flanged, silver braze and steel socket weld ends. Write for bulletin No. 117.



HOW ARE YOUR TEETH WEARING?



Here's what happened to the stainless steel gear teeth of a good conventional gauge movement after 500,000 cycles of operation at 1200 pressure pulsations per minute. In contrast — after 30,000,000 cycles, the cam facing of the *Helicoid movement* was merely burnished, and the accuracy of the Certified Gauge was unaffected. This was the result of a test made by an independent laboratory.



Only Certified Gauges are made with the Helicoid movement. This means there are no teeth to wear out or get sticky. The smooth rolling action of the Bakelite cam against the hard bronze roller practically eliminates wear.

HAVE you looked at the gear teeth in your pressure gauges lately? Are they so worn that your gauges are inaccurate and unreliable? If so, better replace with Certified Gauges to eliminate gear teeth trouble.

All Certified Gauges are guaranteed accurate to within ½ of 1%. They stay accurate longer. They are ideal for pumps, compressors, presses, turbines, etc. Send for catalog.

ARMY NAVY E

Certified GAUGE AND INSTRUMENT CORP.

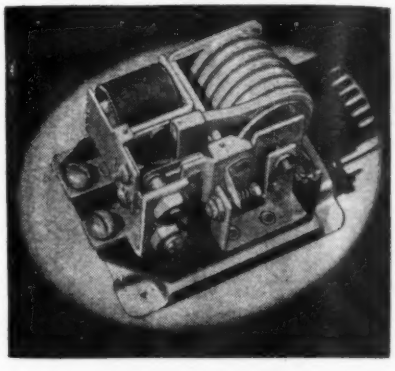
34-18 Northern Boulevard Certified GAUGE U.S.A. **Long Island City 1, New York**

6-CG-4

tained with conventional tube and shell construction.

Coil element twists like a spring and relieves itself automatically of all stresses; hence there is no interleakage between tube and tube sheet. Heliflow has the minimum number of joints on either fluid circuit, and these joints are not under expansion strains. This reduces possibility of leakage or contamination between the two fluids circulated.

Heliflow is made in three models. Series A, of single-coil design, is for smaller sizes, down to one-half sq ft. Series B, of multiple-coil design, permits the addition of surface up to about 150 sq ft. Series C, of multiple-coil multi-cell design, is for larger flow rates with added heat transfer surfaces. *Graham Mfg Co*, 415 *Lexington Ave, New York* 17, *N. Y.*



Reverse-Current Relay

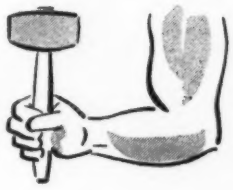
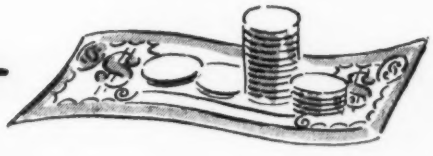
TYPE 9100 REVERSE-CURRENT relay, for low-voltage dc application, operates on stationary or mobile equipment. The design incorporates a magnetic latch which prevents accidental closing of armature because of vibration up to ten times force of gravity. Contacts are rated 100 amp at 30 v dc maximum. Type 9000, without magnetic latch, is also available where severe vibration and shock are not encountered, in sizes as low as 300 watts, at 6, 12, 18 and 24 v dc. *R-B-M Mfg Co, Logansport, Ind.*

Mechanical Packing

OUTSTANDING FEATURE claimed for *Lubraloy Process* mechanical packing is that it is self-lubricating. A novel alloy structure of antifriction metals, is impregnated by a special process with heat-resisting lasting lubricants which cannot be driven off by heat or pressure and are emitted constantly. Packing is self-forming and molds itself easily to size and shape of stuffing box, creating a perfect seal, yet allowing rods or pistons to operate with minimum friction. Packing will soon be available in suitable form for spools, die-formed rings and sets, coils, etc. *Flexrock Co*, 3677 *Filbert St, Philadelphia* 4, *Pa.*

Fluorescent Fixture

QUICK-LITER has a lateral-ribbed reflector that is said to provide for straighter and stronger fluorescent lighting installations. Lateral ribs act as corrugations in a metal barrel, minimizing dents because of accidental blows or droppings. Also die-formed

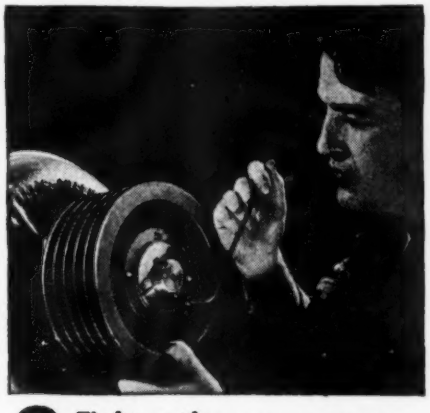
Trade this  for this ; save and 

No more *forcing* of sheaves. Simple wrench operates Allis-Chalmers' "Magic-Grip" — ***fastest mounting and demounting sheave on the market.*** Saves time, money.

SEE HOW QUICKLY, EASILY THIS NEW SHEAVE MOUNTS AND DEMOUNTS

1 Place sheave on shaft. Slides on smoothly because clearance is provided by expanded bushing. There's *no* hammering — *no* forcing! Complete sheave and bushing unit comes intact—ready for quick, easy mounting.

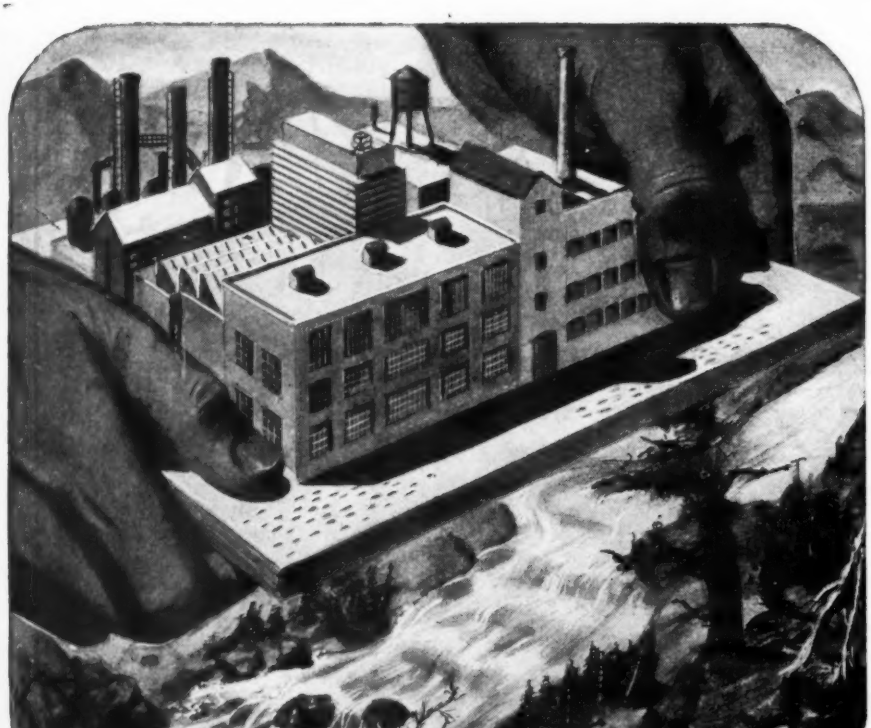
2 Slide to desired position. Sliding easily, sheave can be placed *exactly* according to straight-edge . . . giving you true alignment with resulting smooth performance. A minimum of time is required.



3 Tighten three capscrews — and it's ready to go! Entire sheave is locked securely to shaft and *grips like magic!* No set screws to damage shaft. Send for Bulletin B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1855

Allis-Chalmers Texrope "MAGIC-GRIP" SHEAVES



Like putting your plant
BESIDE A MOUNTAIN STREAM

Chlorination of process and cooling water is like having a mountain stream at your doorstep. No longer need raw water bacterial quality be a major factor in selecting a site for a new manufacturing plant . . . nor need a requirement for water of higher bacterial quality necessitate a change from your present location.

Wallace & Tiernan chlorination can eliminate the effect of pollution, making any raw water supply bacterially suitable for industrial cooling water or for process purposes, at a cost often less than the resulting yearly savings in fuel and manpower.

From their wide experience in solving water treatment problems in scores of different industries, Wallace & Tiernan Engineers will recommend the method best adapted to the individual needs of your plant.

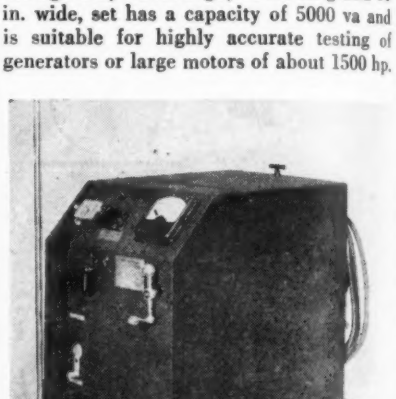
CD-14

WALLACE & TIERNAN
PRODUCTS, INC.
Manufacturers of Chlorine and Ammonia Control Apparatus
Belleville 9, New Jersey — Represented in Principal Cities

ribs produce straighter reflector edges to effect a better looking lighting job. *Quick-Liter* is a combination hot and cold cathode fixture. Lamps start without flicker and they light even at low temperatures and at low or irregular voltages. They are available in 2-40 and 4-40 watt fluorescent lamp sizes, for 115- or 230-v 60-cycle ac operation. *Edwin F Guth Co*, 2615 *Washington Ave, St. Louis* 3, *Mo.*

Test Set

PORTABLE AC TEST SET, mounted on a 3-wheeled truck so it can be moved about easily and plugged into any convenient 115- or 230-v, 60-cycle outlet, supplies smooth, stepless test voltages from 0 to 15,000 v. Though only 36 in. high, 49 in. long and 30 in. wide, set has a capacity of 5000 va and is suitable for highly accurate testing of generators or large motors of about 1500 hp.



transformers up to several thousand kva, short lengths of power cable, also insulators and other pole-line hardware.

Complete equipment consists of a step-up transformer, built-in electric timing clock, double-scale switchboard voltmeter for full-range accuracy, voltmeter scale selector switch, air-circuit breaker with instantaneous overload trip, built in a case inclosing all energized parts. A 15-ft supply cord and plug and two 15-ft shielded high-voltage leads with insulated test handles are also included.

With exception of a safety foot-switch that shuts off the high voltage when released, all controls are mounted on an inclined control panel facilitating operation of the set from either a standing or seated position. *General Electric Co, Schenectady* 5, *N. Y.*

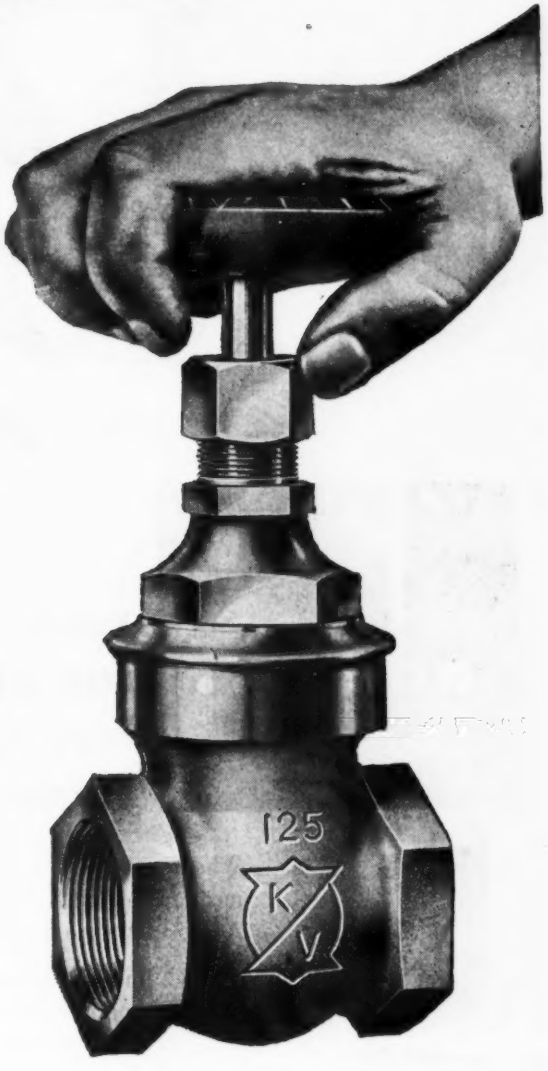
Tank Heater

IMMERSION STEAM TANK HEATER is ideally used with any material whose viscosity can be lowered by heating. The heaters speed up the emptying of tank cars and permit many viscous materials to be handled in cars not fitted with steam coils.

Heater consists of a number of lengths of Brown *Fintubes*, connected in series, and inlet and outlet steam lines. Heaters have low center of gravity. They can be handled safely by one man, or easily by two men. Cross handles aid in positioning the heater over discharge outlet in the car, in blocking the heater at various depths and removing

"Trifles make perfection but perfection is no trifle"

NO "HOT SPOT" ON THIS KENNEDY HANDWHEEL



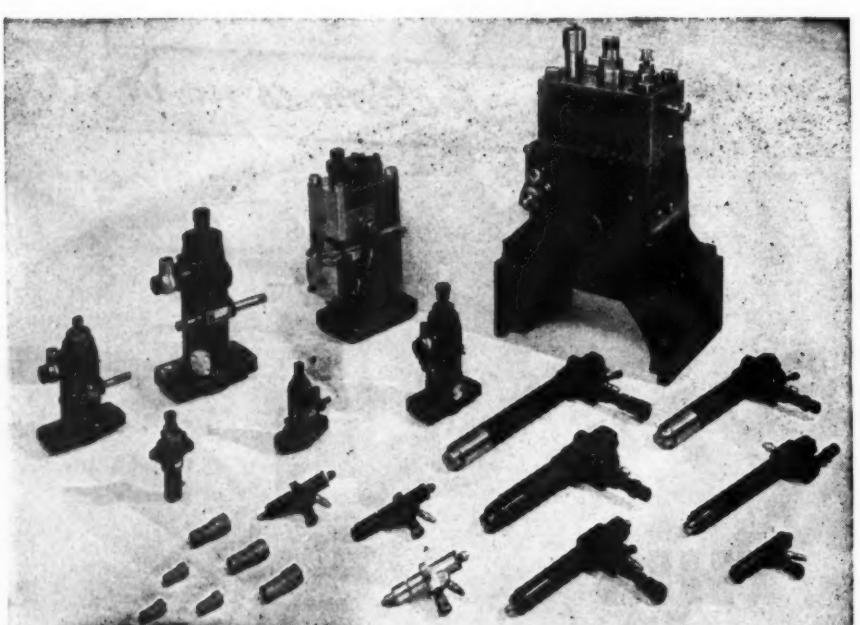
You never need fear burned hands when you grasp this Kennedy malleable iron non-heating handwheel with wheel nut lower than the top. We have designed it to have the maximum possible heat radiating surface, and at the same time to provide non-slip grip. You'll find this Kennedy detail mighty helpful when you want to operate a valve in a hurry on steam service. This handwheel is used on most Kennedy Bronze Valves; and similarly careful attention has been given to making all other Kennedy Handwheels assure a firm, comfortable grip with ample leverage.

Not a vitally important point in valve design, but it is just one of many indications that from top to bottom, we have exerted every effort to make Kennedy Valves the kind you want to standardize on.

One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.

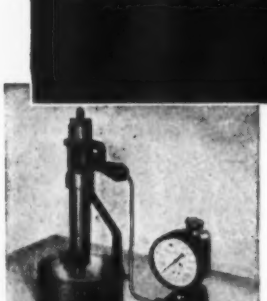
THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

KENNEDY valves... pipe fittings... fire hydrants



adeco..

YOUR SOURCE FOR DEPENDABLE FUEL INJECTION EQUIPMENT



Whether you need standard fuel injection equipment or special units built to your specifications, Adeco offers the logical source of supply.

Today's line of Adeco equipment, the outgrowth of long experience in serving the Diesel industry, includes: Standard fuel injection pumps in plunger diameters from 7 mm. to 31 mm.; a complete line of standard nozzles and nozzle holders, including the water-cooled type; and the Adeco nozzle tester.

All Adeco products are built to highest standards, with years of trouble-free operation behind them to testify to their reliability.

ADECO NOZZLE TESTER

For Low-Cost Maintenance

America's most widely used nozzle tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors on bench or engine. Prevents costly delays and possible damage to engine. Standard or Navy-approved gauge. Ideal for testing hydraulic equipment. Write for bulletin.

ADECO

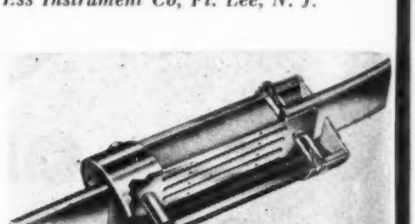
AIRCRAFT & DIESEL EQUIPMENT CORP.

4401 NO. RAVENSWOOD AVE. • CHICAGO 40, ILLINOIS

unit after car is empty. It is furnished in two sizes—No. 642 for tank cars and No. 442 for tank trucks. *Brown Fintube Co, 160 Filbert St, Elyria, Ohio*

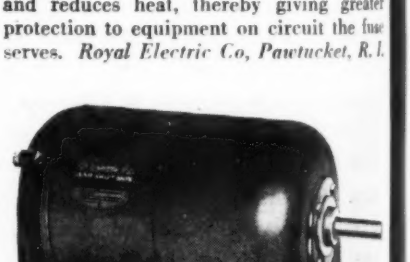
Firebox Flame Indicator

A NEW LENS has been developed for *Cat's-Eyes*, a firebox flame indicator, to permit visual inspection of boiler and furnace interiors while in operation. *Cat's-Eyes* with Type *O* lenses show at a glance, from distant points, the flame with its characteristics of color, turbulence and haze, and objects inside a boiler or furnace, such as tubes and articles being heat treated, etc. *Ess Instrument Co, Ft. Lee, N. J.*



Non-Renewable Fuse

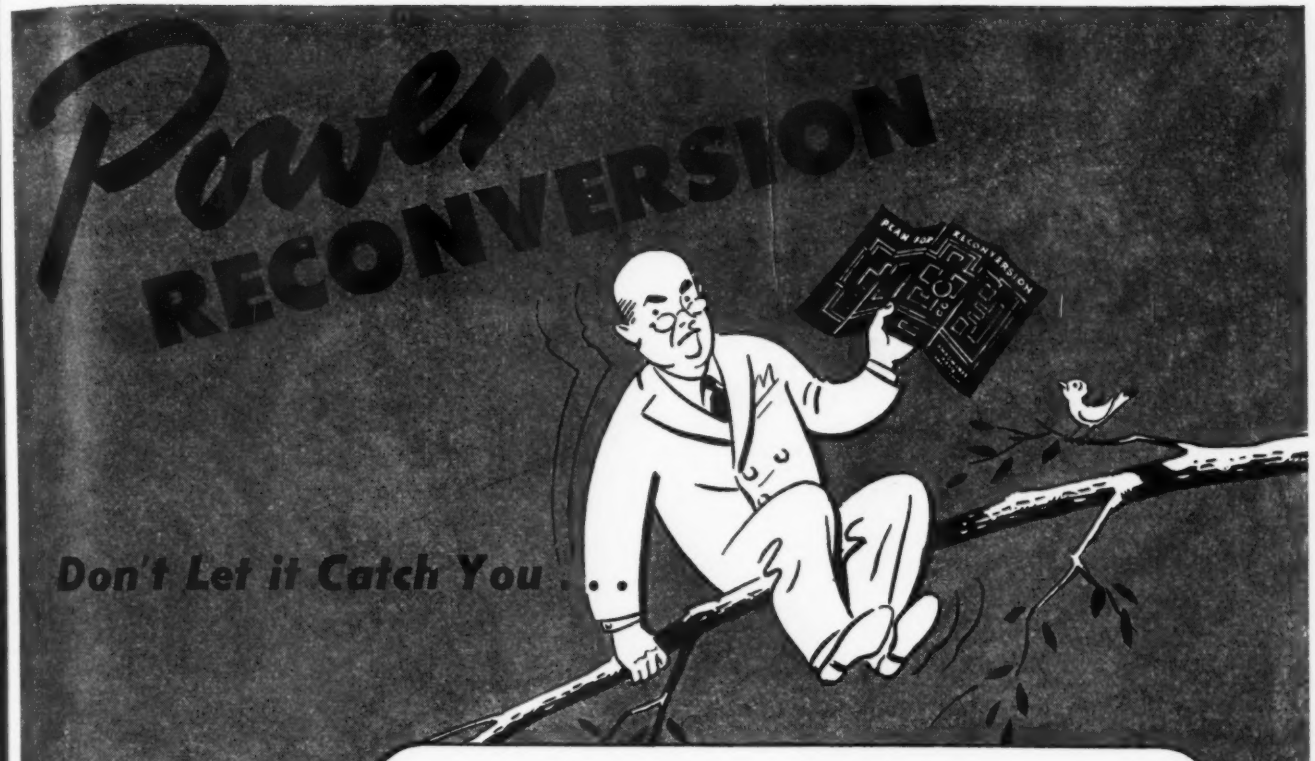
ROYAL-NOARK non-renewable cartridge fuse incorporates a grid link, which, on size shown above, replaces four single links. Therefore, there are only two solder connections to blades, instead of eight, reducing possibility of loose contacts and increasing heat distribution. By employing a metal crossbar to position link and blade, they can be anchored into complete assembly by a stud riveted through ferrule and casing into crossbar. This method of holding fuse parts together prevents twisting and turning. Company claims that this girder assembly eliminates loose contacts and reduces heat, thereby giving greater protection to equipment on circuit the fuse serves. *Royal Electric Co, Pawtucket, R. I.*



Gearshift Drive

THE 4-SPEED GEARSHIFT DRIVE powers machine tools and other equipment requiring motor capacities of 1 hp or less. Unit is rated at $\frac{1}{2}$ and $\frac{3}{4}$ hp at 1200 rpm and 1 hp at 1800 rpm. Simple and compact, Type R drive is designed for continuous operation, with ample overload capacity. A Lima semi-inclosed dripproof ball-bearing motor, of either 2 or 3 phase, 50 or 60 cycle, 220, 440 or 550 v, is furnished as a standard integral part of unit. Type R is reversible in all speeds with the use of a reversing drum control. Single-phase units in above

Power RECONVERSION



Don't Let it Catch You . . .

LET Pritchard Power Engineers help you start your reconversion on the right track. Don't be caught "out on a limb" when the time comes for quick reconversion to competitive low-cost power production.

Pritchard Power Engineers can transform your present thoughts into plans and action—preparing you NOW to take fullest advantage of the latest methods and processes.

Pritchard is equipped to carry the job as far as you wish . . . Estimates—Designs—Engineering—Purchasing—Construction . . . one step at a time or as a complete job. Write or wire for consultation. No obligation.

POWER DIVISION

J.F. Pritchard & Co.

ENGINEERS AND CONSTRUCTORS

FOR THE CHEMICAL • PETROLEUM • GAS AND POWER INDUSTRIES

Manufacturers of Mechanical and Atmospheric Cooling Towers

Kansas City 6, Missouri

"There are some things about a Globe Valve yoke that are mighty important!"

Right! That's why LUDLOW STEEL GLOBE VALVES have:

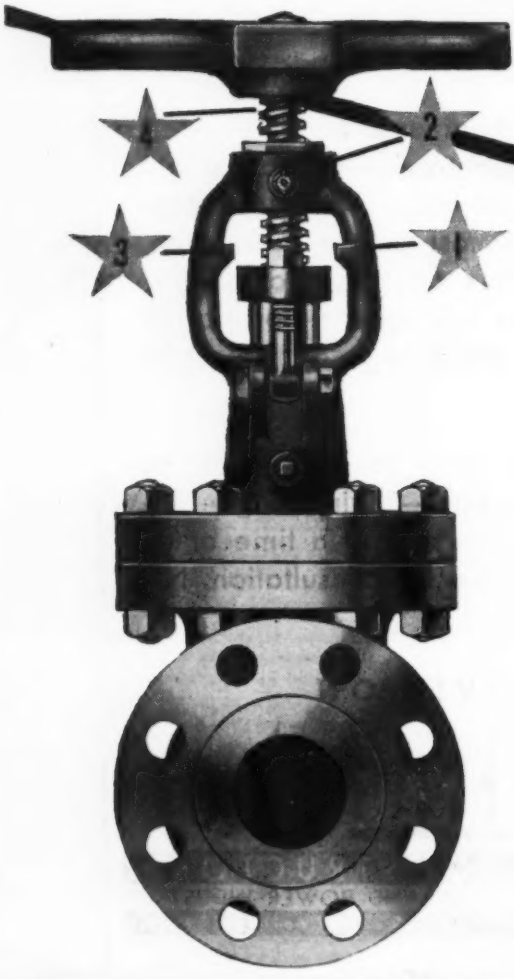
1 A bow-shape yoke, to minimize stem stresses due to temperature changes.

2 An easily lubricated yoke nut, with ample stem-thread engagements.

3 Convenient shelves to hold stuffing-box follower aside during repacking.

4 A stem with an Acme thread, to permit wear compensation.

G-3

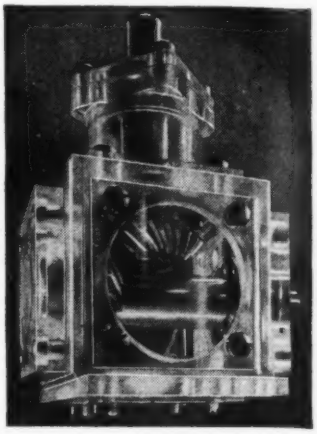


Yes, we designed for temperature influence — and for every other factor that can affect valve performance. The Ludlow Cast Steel Globe is daily giving thousands of satisfied users the enduring, dependable service that has made Ludlow Valves famous. . . . Write today for complete catalogs.

The LUDLOW VALVE SINCE 1866 MFG·CO·INC·TROY·N·Y·

sizes will be available when conditions permit.

Unit is equipped with antifriction bearings throughout. Shaft and all gears are of heat-treated alloy steel, running in a bath of oil. With evenly distributed speed changes, the ratios of Type R are 1 to 1, 1.33 to 1, 2 to 1 and 4 to 1. Shifting is by a small lever which can be extended to any convenient position as required. *Lima Electric Motor Co,* 7003 *Findlay Rd, Lima, Ohio.*



Control Units

STANDARDIZED SYSTEM of remotely operated mechanical controls is suitable for cranes, winches, windlasses and steering gears, for opening and closing large valves with motors, ventilators, and for operation of banks of furnace doors, factory windows, etc. Related units are for power operation under speeds not exceeding 1800 rpm. Terminal connections are constructed so that rearrangement of same units can be made without disturbing assemblies or affecting their internal adjustment.

Steady shaft assembly is engineered in two standard models. One is for attachment to surface which is square to the shaft, particularly for deck, bulkhead, or any other watertight mounting. The other is for attachment to surface which is parallel to shaft.

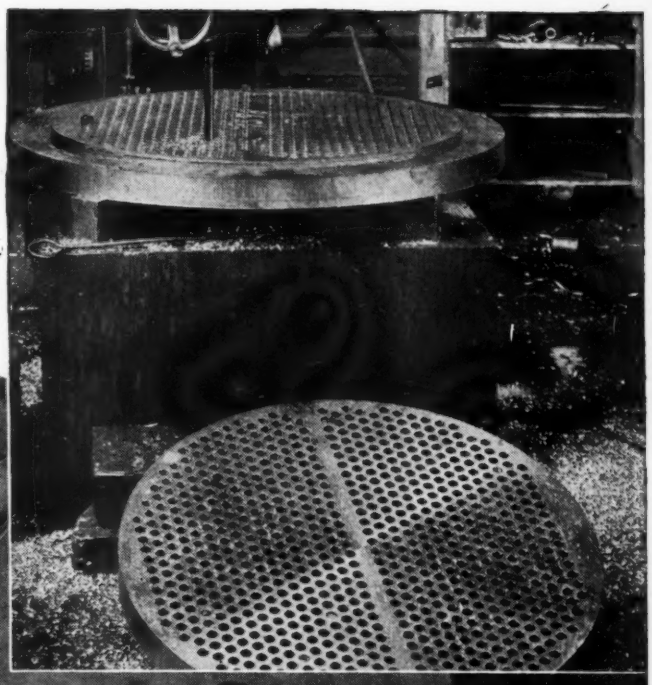
Full freedom is possible with spiral bevel-gear assemblies (shown above) because all shaft ends are interchangeable. Either two shaft ends or three shaft ends, depending upon kind desired, are connected to other control units.

Universal shaft assembly is made in lengths ready to be installed, or with one end yoke to be field welded after tube is cut to suitable length. Telescoping splined portion between end yokes permits ready installation and removal without disturbing other control units. *M L Bayard & Co,* 1945 *Indiana Ave, Philadelphia* 32, *Pa.*

Aluminum Ladders

COMPLETE LINE of industrial ladders, in all-aluminum tubular-rail and channel-rail construction, offers advantage of light weight, plus great strength and safety. Light-, medium- and heavy-duty industrial designs, in both single and extension models, are included. *Duo-Safety Ladder Corp,* 809 9th *St, Oshkosh, Wis.*

Condenser Tube Plates by REVERE



Reaming Tube Sheet

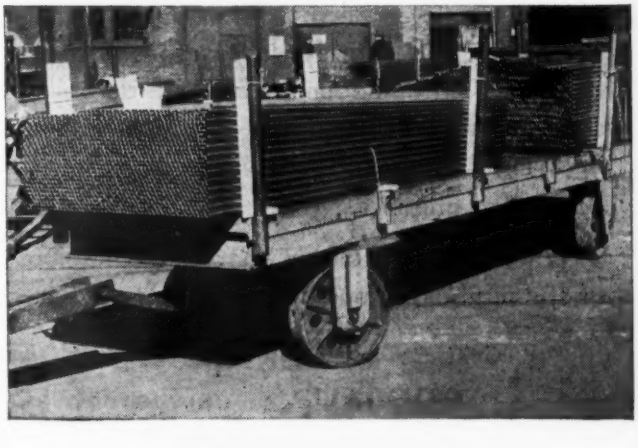
Finished Revere Plates

JUST as Revere Condenser Tubes are preferred in thousands of power plants because of their long, satisfactory service, so are Revere Plates. The two make a perfect combination, both being made with the same high skill, to the same standards. Revere Plates are produced by hot-rolling "cakes" after machining the original casting for a perfect surface.

Revere's long experience makes it possible to deliver to you plates that are dense, free from blow holes and surface imperfections, characterized by flatness, accuracy of gauge, resistance to corrosion, and machinability.

Revere Condenser Tube Plates are available in squares, rectangles, circles, half-circles, segments, patterns, up to 120 inches. Plates may be obtained having a finished weight up to approximately 11,000 pounds. Muntz Metal is commonly used in steam condensers for generating plants. For special conditions of use Revere also makes plates and sheets of Naval Brass, Cupro-Nickel, Admiralty Metal, Copper, Herculoy, Manganese Bronze. For advice as to the proper alloys for condenser tubes and plates, write Revere.

Below: Condenser Tubes in Revere Plant



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York 17, N.Y.

High-Pressure PACKINGS That *Stay Alive... Longer!*

GOODALL "A-400"

SPIRAL . . . COIL . . . RING

High quality asbestos piston packing for all steam, gas and oil conditions. The closely woven asbestos is treated with an efficient heat-resisting compound. Extreme durability and resilience result from the method used in laying up the center section block and applying the rubber cushion. Finished lubricated, with exterior coating of graphite.

When ordering, please specify diameter of rod, inside diameter of stuffing box, or number of rings for required depth.

Contact Our Nearest Branch or Main Office for Details.

GOODALL • on the Job LONGER!

GOODALL RUBBER COMPANY · INCORPORATED

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

THE GOODALL-WHITEHEAD COMPANIES

Philadelphia • Trenton • New York • Chicago • Pittsburgh • Boston

GOODALL RUBBER CO. OF CALIF.
FACTORY—TRENTON, N. J.

GOODALL RUBBER CO. OF TEXAS
Established 1870

Power News

(*Continued from page* 130)

DEMA States Problems Of Diesel Research

After a series of conferences with deans of accredited engineering schools of the country, the Diesel Engine Manufacturers Assn granted the deans' request for a summary of diesel engine research problems. Titled *Suggested Research Projects of the Diesel Industry*, the summary takes the form of a 10-page report. Topics covered include combustion, injection systems, fuels, lubrication, heat transfer, temperature, metallurgy, instrumentation, exhaust and intake systems, pressure charging and torsional vibration.

The report was drawn up by the educational committee, but preliminary drafts of the text were first submitted to all diesel engine builders in the U. S., whose critical comments were invited. Gordon Lefebvre, president of Cooper-Bessemer Corp is chairman of this committee. Vice-chairman is F H Kilberry, president of Atlas Imperial Diesel Engine Co. W E Wechter, manager, engine sales div of Worthington Pump & Machinery Corp, did the final editing.

Other members of the educational committee are John W Anderson, chief engr, diesel engine div, American Locomotive Co; Paul J Every, mgr sales promotion, Baldwin Locomotive Works; Charles E Beck, sales mgr, Busch-Sulzer Bros–Diesel Engine Co; T C Webb, Clark Bros Co; Roy A Hundley, chief engr, Enterprise Engine & Foundry Co; Henry J Barbour, mgr, sales promotion, Fairbanks, Morse & Co; George Mueller, research engr, General Machinery Corp; T L Guarniere, supervisor, school training, Detroit diesel-engine div, General Motors Corp; L V Armstrong, asst mgr diesel and gas-engine dept, Ingersoll-Rand Co; Walter A Parrish, exec engr, National Supply Co; Roland W Bayerlein, sales mgr, heavy machinery div, Nordberg Mfg Co; and George J Rathbun, pres, Rathbun-Jones Engrg Co.

British Power in Wartime

The total quantity of electricity generated in public supply stations in Great Britain in 1944 was 38.3 billion kwhr, as compared with 37.0 billion in 1943. The increase since 1939 was 45.2%. This information was released in the 17th Annual Report of Britain's Central Electricity Board.

At the end of 1944, the national "grid" comprised 5142 miles of transmission lines, most of which were operated at 132,000 v. According to the report, this grid provided great flexibility for factory installation in wartime. At the end of 1944 the capacity of the 141 stations serving the grid was 11,254,081 kw. War made fuel cost per kwhr in 1944 double that for 1938.

The major source of war damage to transmission lines was from barrage balloons that broke loose in Northwest England and drifted over the whole length of the country before disappearing out to sea.

. . . *in thousandths of an inch*

Mechanical protection of boiler tubes and drums for long periods of time is provided by a brush-applied coating only a few thousandths of an inch thick. This coating is APEXIOR NUMBER 1, a chemically-inert, boiler water and steam resistant paint especially developed for metal surfaces.

Applied by hand brush or power coater, APEXIOR fills the metal pores and joints, preventing contact between metal and water or steam, thus greatly improving internal boiler conditions. APEXIOR also

1. Makes cleaning easier and required less often;
2. Prevents chemical bonding of dirt and scale;
3. Assures better heat-transfer over extended period by keeping boiler cleaner;
4. Prevents acceleration of stress corrosion or embrittlement due to water contact.

THE COATING IS EASILY MAINTAINED

Use of APEXIOR NUMBER 1 as a protection for boiler metal is recommended by all U. S. and Canadian boiler insurance companies. It is used by steam turbine manufacturers to coat shaft and rotor bodies. It is also used on feedwater heaters and deaerators.

FOR "COLD-WET" METAL SURFACES APEXIOR NUMBER THREE

APEXIOR NUMBER 3 provides similar protection for metal surfaces that are exposed to water or moisture at any temperature under 125°F. This special, shiny-black paint resists both fresh and salt water and can be used with potable water.

Organizations like these have used APEXIOR for years:

American Viscose Company
Bethlehem Steel Co.
Lehigh Portland Cement Co.
Firestone Tire & Rubber Co.
National Lead Co.
International Paper Co.
Gulf Oil Corporation
Carnation Co.
E. I. DuPont de Nemours & Co.
Omaha District Utilities

To learn what APEXIOR brush-applied protection can mean to you, write for Bulletin 1290, to the Dampney Company of America, Hyde Park, Boston 36, Massachusetts. *Main Office:* Hyde Park, Boston, Mass., *Branch Offices:* Atlanta, Chicago, New York, Detriot, Philadelphia. *Engineering Sales Representatives* — Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B.C., Montreal, P.Q., Havana, Cuba, Honolulu, T. H. *Marine Dept.*, 114 Liberty Street, New York 6, N.Y.

APEXIOR

Keeps new metal new . . . Gives old metal new life

The **DAMPNEY COMPANY**
of America
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park 36, Mass.

Please send free Bulletin 1290 (Industrial) ☐
1305 (Marine) ☐

Name.....

Company.....

Address.....

ADD PRESSURE SEAL

to quicker fit...

THIS MAY BE NEWS to you ... You can get all the advantages of Laminum *plus* the sealing of oil and pressure in bearings ... in *babbitted* Laminum shims. The babbitt lugs are securely locked into the Laminum. Details on request.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated

61 Union Street • Glenbrook, Conn.

LAMINUM

THE SOLID SHIM THAT peels FOR ADJUSTMENT

New Development Improves Gas Engine

A new engineering development makes possible the supercharging of a gas engine and its instantaneous conversion from oil or gas fuel. In tests by Cooper-Bessemer engineers on their LS-8 cylinder gas-diesel engine, which has an ordinary rating of 1100 hp, this engine was successfully supercharged up to a rating of 1600 hp at 327 rpm. When it was changed over to gas, which was done on full load, the engine exhaust temperatures were decreased and the turbocharger speed was also lowered.

The reason for lower exhaust temperature is better combustion on gas than on oil. Lower turbine speed is the result of better combustion, but proves that scavenging was with pure air and not with gas, since if any gas was blown through, it would burn in the exhaust manifold, thereby increasing turbine speed uselessly. The engine readily carried a 10 percent overload on gas.

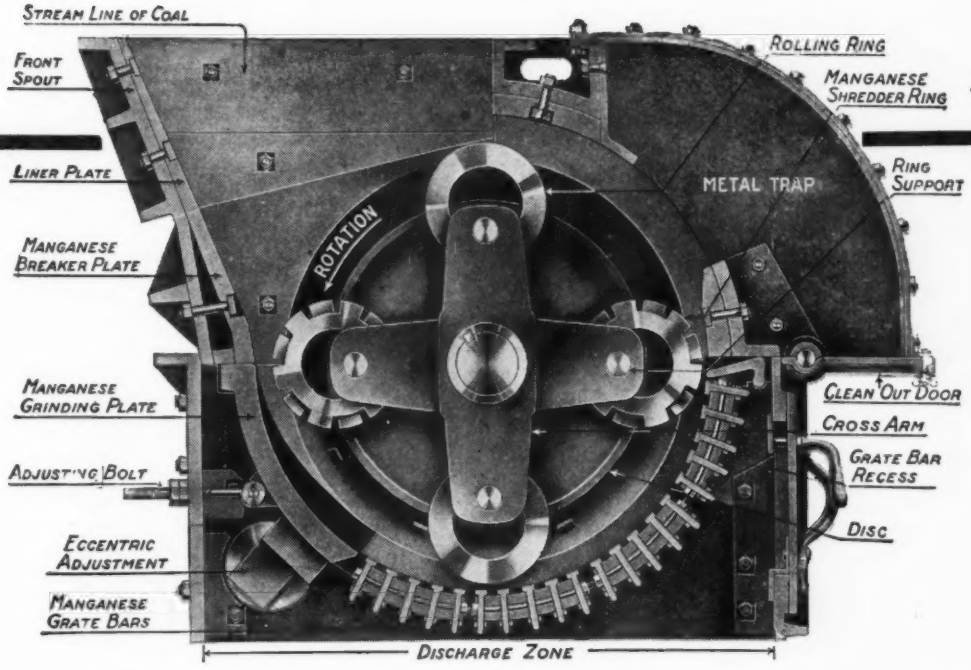
Ralph L. Boyer, chief engineer of Cooper-Bessemer, said that the supercharged engine provides the customer with more power for a given space and weight, which is becoming a matter of importance because of necessity of greater economy of space in modern plant construction. This engine also makes possible better fuel economy because it provides a better overall thermal efficiency than the atmospheric diesel.

Supercharged Engine

Many diesel oil engines are of supercharged design and this development makes it feasible to employ gas on such engines and still have a fully convertible unit in case of a gas shortage. In the atmospheric engine the combustion chamber volume may not be swept clean of exhaust gases and therefore each charge of air is diluted to a certain extent with burned gas. On the supercharged engine, since it has a positive pressure on the air supply, the inlet and exhaust valves are purposely timed so there is a period during which they are open together.

Since the air is under pressure a certain quantity is blown through the cylinder and out the exhaust. This carries with it burned gas, thereby securing a complete scavenging. The exhaust valve then closes, permitting air supply to charge cylinder with additional pure air under pressure. While greater portion of increased rating permissible by supercharging comes from the fact that the cylinder is filled with more pounds of air, quite a fair percentage of increase comes from this thorough scavenging process.

Gaseous fuel engines have not been supercharged in the past because it is necessary to feed into the engine a mixture of air and gas and this scavenging process would waste gas by blowing through the mixture, instead of pure air, as with the oil engine. Quite some time ago Cooper-Bessemer engineers had the idea of delaying admission of gas into intake air to permit the scavenging process to take place with pure air. The gas is admitted after the exhaust valve is closed. The patent on this has been applied for and allowed.



One of the Rolling Rings shown in cut-a-way section of the American Ring Crusher above. Made of manganese and weighing about 27 pounds, these rings are thrown by centrifugal force against the inside of crusher, rolling and crushing the coal passing through.

The twenty cutting edges of each of the manganese shredder rings split the coal and prevent clogging as they are swung out by centrifugal force and come in contact with the material being reduced. The fact that they are free to swing out of position eliminates any chance of damage in the event that tramp iron is present in the coal.

The "INSIDE STORY" of AMERICAN RING CRUSHERS and how to solve your Problem of COAL PREPARATION

Long service life and low costs for maintenance and operation are assured in the "American" through the use of heavy cast steel, reinforced construction, anti-friction bearings, alloy steel rotor shaft and high carbon steel shafts for supporting rings. Manganese steel is used for crushing parts such as breaker plate, grinding plate, grate bars and rings.

By a simple adjustment of the grinding plate, even while crusher is in operation, fineness of crushing can be instantly varied to suit requirements.

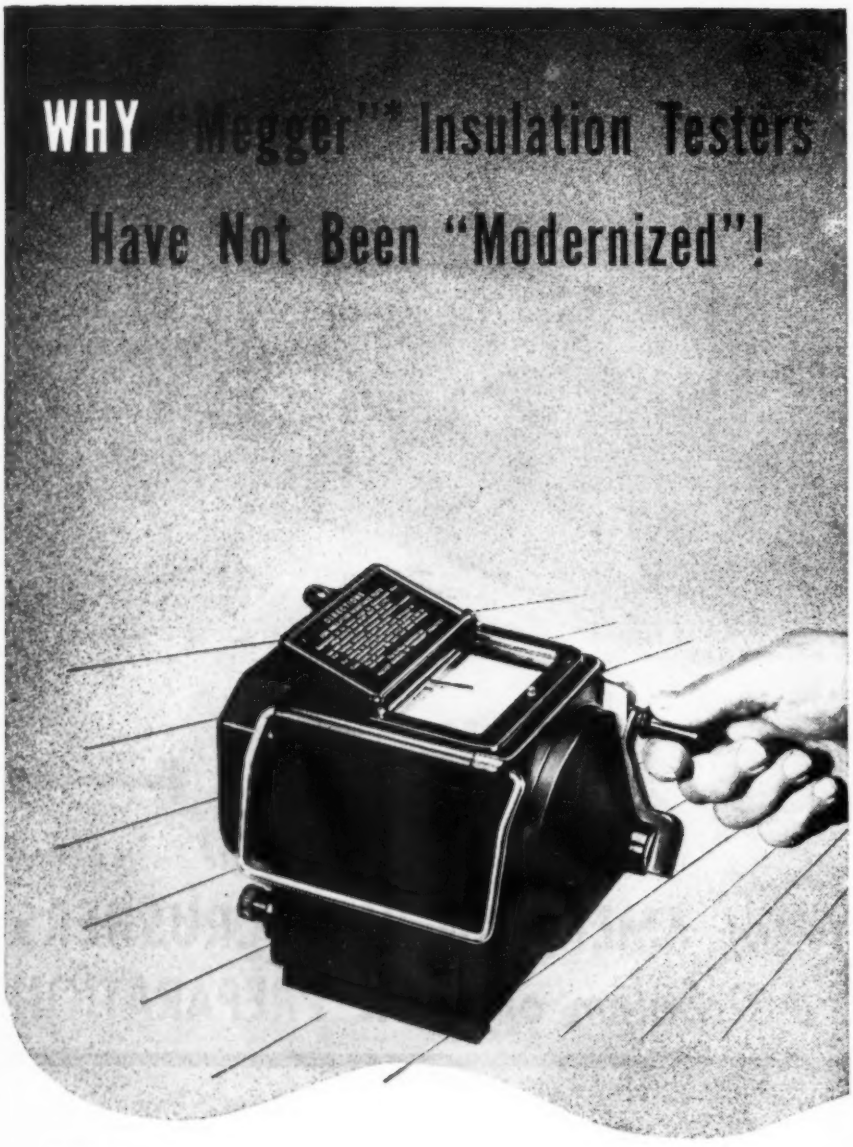
These and other features of the "American" result in a crusher that can be depended on to prepare coal exactly to required specifications at a cost for power, interest, depreciation and maintenance of less than 1¢ per ton.

Ability to prepare *any* coals regardless of grindability index to *any* specified fineness and to do the job at low cost, makes the "American" a crusher of outstanding value in easing the burden placed on power plants by a limited supply of premium coals. With the American you can properly prepare *any* coal that is available. It will pay you to give these facts your most careful consideration.

Send at once for further information on American Rolling Crushers.

AMERICAN PULVERIZER COMPANY
1219 MACKLIND AVENUE
ST. LOUIS, 10, MISSOURI
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

WHY "Megger"* Insulation Testers Have Not Been "Modernized"!



You may have wondered why we have not departed from the original operating principle of "Megger" insulation testing instruments—why we have not changed from hand operation to battery operation, or have not made use of electronic tubes or other devices. The reason is simple.

Ours is the business of building and supplying insulation testing instruments that can be depended upon to operate accurately and unfailingly—anytime and anywhere. To that end we have naturally considered, investigated and tested every element that might effect improvement. Years of research and the performance records of many thousands of "Megger" instruments have demonstrated that the classic simplicity of the "Megger" Insulation Tester with its hand-cranked generator and complete independence of any parts requiring replacement or adjustment is the best assurance of sustained, trouble-free, dependable service. "Megger" insulation testing instruments have been and will continue to be built to the high standards of fine instrument making practice.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-P.

**Trade Mark Reg. U. S. Pat. Off.*

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

Army Engineers Veto Potomac Dam Project

Board of Army Engineers for Rivers and Harbors will submit an adverse report on the proposal to build 14 multipurpose dams in Potomac River Basin, advanced by the District Engineers, after nearly 1200 residents of Va., W. Va. and Md. trooped to Washington, D. C., to oppose the project at a public hearing recently.

More than a half dozen members of Congress led the attack against the plan at the hearing, pointing out that the $235,000,000 project would flood thousands of acres of fertile farmland, dislocate the home life of hundreds of people, inundate some of the nation's most historic landmarks and necessitate removal and relocation of highways and railroads. Senator Harry F Byrd, Virginia democrat, criticized the district engineers who drafted the report for taking an authorization to study flood control and submitting a project that is more than 90% for the creation of hydroelectric power.

The Board's adverse report will be placed before Maj Gen Eugene Reybold, Chief of Engineers, who will make a further study. Copies of his report will be sent to the governors of states and agencies affected by the project for their comments or recommendations; then the report goes to Congress for consideration by the House Committee on Flood Control.

Floating Power Plants Moved for New Duties

Possibility that two of five floating power plants available for military duty may be redirected to new points of service arose with the end of the European war.

Two of four Defense Plant Corp floaters, each of which operates at 30,000-kw capacity, are serving in the European theatre and will not be moved in the near future. A third DPC floater, scheduled for the European theatre of operations, may be redirected to the Pacific. The fourth floater, which has been serving the Jacksonville, Fla., municipal system since April, might be commandeered by the Navy for use at Pearl Harbor although this is not regarded as likely. If the Navy takes the 30,000-kw floater, it would be expected to send to Jacksonville a 10,000-kw power train, now laid up for standby use at the Philadelphia Navy Yard. The Jacksonville system will need assistance only until mid-June, when a 30,000-kw machine, now down for maintenance for the first time in four years, is to be back on the line.

No decision has been reached as to whether the *Jacona*, requisitioned by the War Shipping Administration from the New England Public Service Co, will be sent overseas or not. The *Jacona* has a 20,000-kw plant.

An outstanding problem is that of returning men and women from the armed forces to their former jobs. Caterpillar Tractor Co, Peoria, Ill., gives an answer to the challenge in a new booklet, *Back on the Job*. Request Form 8870 when writing to Caterpillar for free copy.

HOODOO SMASHERS!

America's newest and widest line of V-Belts — Allis-Chalmers' Texrope — solves problems that have hoodooed drives in almost every industry . . . see what they can do for you!

I ROUT THAT OLD BUGABOO, STATIC ELECTRICITY. I'M STATIC-RESISTING SUPER-7. MY BUILT-IN CONDUCTING ELEMENT CARRIES CHARGES TO THE MACHINE WHERE THEY'RE GROUNDED

A 1861

♪ *Tune in the Boston "Pops", Blue Network, every Sat. Eve.*

IT PAYS TO MAKE ALLIS-CHALMERS YOUR

V-BELT DRIVE HEADQUARTERS

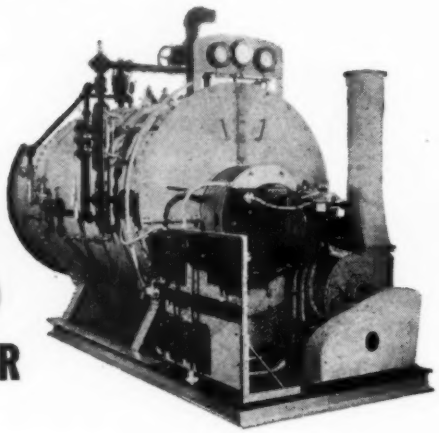
Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

Says the Power Plant Engineer:

"YOUR JOB CAN BE BETTER TOO"

"Here's what happened when I mailed a coupon like the one below:

1. *The management has a much better understanding of me and my job . . .*
2. *I have an appropriation for a new, completely modern steam plant with an overall efficiency stepped up to 80% or higher — a*



PREFERRED UNIT STEAM GENERATOR

Compact, self-contained, completely coordinated, consisting of boiler, oil burner, induced draft fan, controls, piping, wiring—everything ready to hook up and start the burner. Requires no stack, no special foundation, minimum floor space. 20 to 500 HP sizes.

THIS CAN HAPPEN TO YOU

Send the coupon and you'll get two valuable things FREE . . . . A 36-page booklet packed with vital information on steam production—facts and ideas for you to pass on to the management for the betterment of your job . . . And a folder giving full information on Preferred Unit Steam Generators. Sending this coupon may prove the biggest thing you've ever done for your future—how about sending it NOW?

SIGN AND MAIL NOW — — — — — — — — — — — — — — — — —

Preferred Utilities Mfg. Corp.
1860 Broadway, New York 23, N. Y.

Please send me DIVIDENDS FROM YOUR POWER PLANT and full details on PREFERRED UNIT STEAM GENERATOR.

NAME .....

ADDRESS .....

P-6-45 .....

PREFERRED UTILITIES

The 1800th marine boiler built for the U.S. Navy combat-ship program by Babcock & Wilcox Co has been installed in the aircraft carrier U.S.S. Franklin Delano Roosevelt, which was launched recently. Like her sister ship, the U.S.S. Midway, she is equipped with 2-furnace single-uptake express boilers. The boilers in the Roosevelt furnish sufficient power to generate electricity for a city of a million population.

Office of War Utilities authorizes installation of several turbines and boilers, including: (1) 37,500-kw unit and boiler at Harding St station of Indianapolis Power & Light Co, the boiler capable of turning out 400,000 lb of steam per hr (2) 25,000-kw unit and two boilers for Inglis station of Florida Power Corp, north of St. Petersburg (3) additional boiler, capable of generating 185,000 lb of steam per hr for Rio Grande station of El Paso Electric Co (4) 7500-kw turbine generator only for Albuquerque Gas & Electric Co. Unit is to be transferred from a station built to serve the Lake Charles, La., magnesium plant of the Defense Plant Corp, and was sought by the Army to handle additional loads in the area.

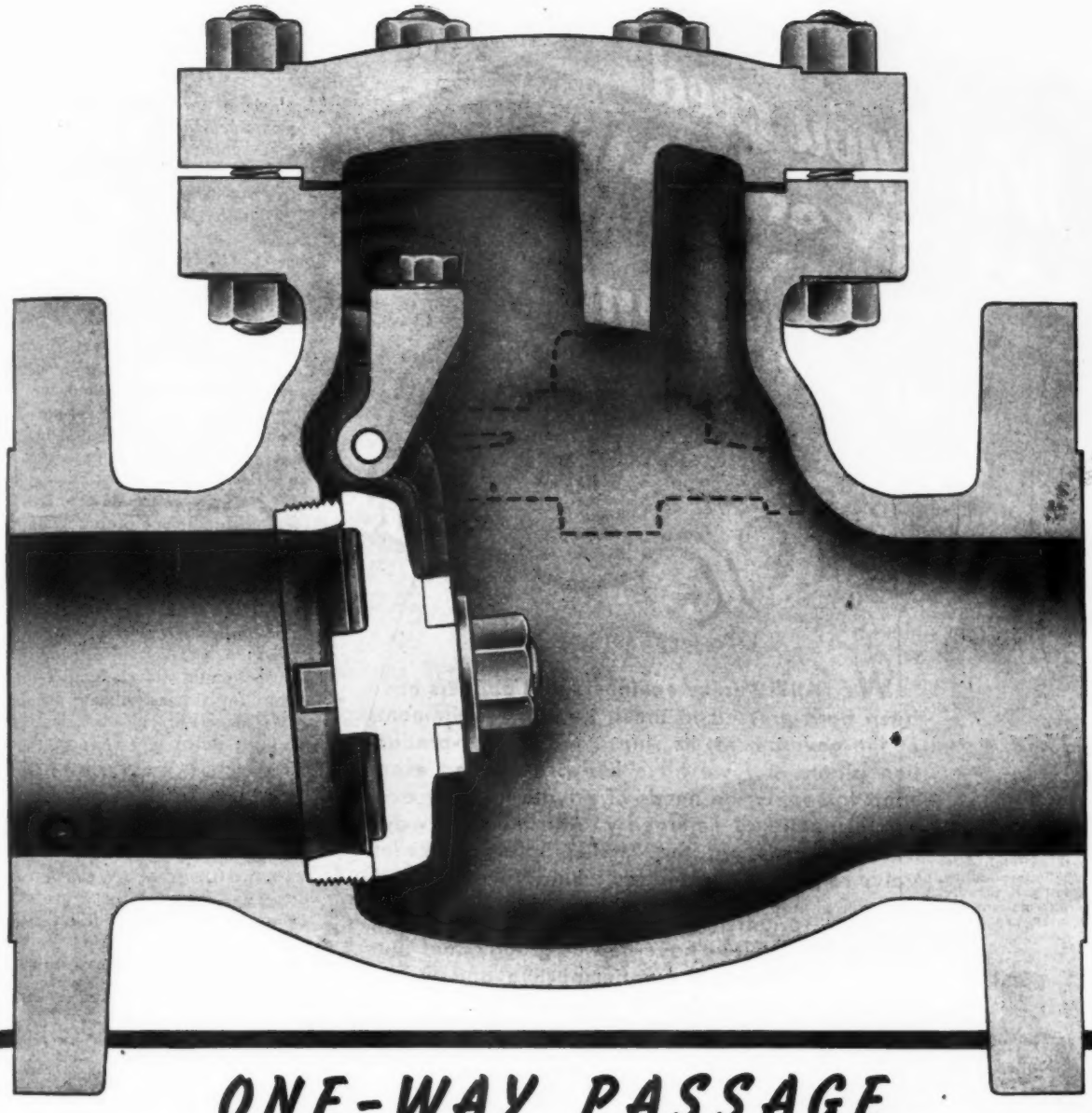
American Society of Refrigerating Engineers cancels its 32nd Spring Meeting, scheduled for Milwaukee, June 11-13, in accordance with Office of Defense Transportation's current order on curtailment of meetings and conventions. However, Spring Meeting papers will be prepared exactly as in past seasons, and five of them will be published in a special Spring Meeting issue of *Refrigerating Engineer*, in June.

Walt Disney welding movie, 16 mm, with color and sound, is available to schools, technical societies, factories, shipyards and industrial groups, at no cost except transportation on request to The Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio. Running time is 20 min. Using the anmiated character "Mr Shrink," film deals not with sponsor's equipment but with the cause and cure of distortion. Treatment is fundamental, elementary and directly practical.

Booklet Reviews

THE STORY OF THE DIESEL *Prepared and pub by the Diesel Engine Manufacturers Assn, 1 N La Salle St, Chicago 2, Ill. 32 pp, available on request from Assn.* Booklet discusses diesel's postwar future, its present fields of application and advantages over other types of power. The beginning and development of the industry are also covered. A chart depicts the industry's enormous growth in hp output from 1937 to 1944. A section describing opportunities for young men in diesel engine industry will be of special interest to returning war veterans.

RESEARCH, INVENTION, AND PATENTS By *Andrey A Potter. Available on request to Industrial Research Institute, 60 E 42nd St, New York 17, N. Y.* Pamphlet explains philosophy of American Patent System.



ONE-WAY PASSAGE

THERE'S no round-trip ticket . . . *but only one-way passage* . . . for fluids when you use the OIC Cast Steel Swing Check Valve. When this valve **seats,** it positively prohibits back-flow.

Furthermore, there's always a free flow in the right direction. The disc swings clear above the waterway, leaving it in wide-open position.

The entire disc assembly is removable through the cap opening. Its suspension from two integral brackets inside the valve body eliminates the necessity for drilled holes in the body casting.

OIC Cast Steel Valves . . . Checks . . . Globes . . . Angles and Gates . . . are available in the 150 and 300-pound pressure classes, with screwed, flanged or butt welding joints. They embody the same qualities of workmanship and materials that have made OIC Bronze and Iron Valves so outstanding for 62 years.

There is an OIC Distributor near you, ready to demonstrate to you the many superior features of OIC Cast Steel Valves. Call him . . . or write to us for details.

ARMY E NAVY

OIC

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883

When you need SAFETY or RELIEF VALVES you don't want...

DELAYED DELIVERIES

FARRIS Vapor or Liquid Service Valve No. 1775. For pressures to 600 lbs. Sizes ¾" to 6". Enclosed spring, high lift, full port capacity. Available with pressure-tight cap; test lever; pop action.

We FARRIS Valve engineers and builders have been hard pressed to meet the war requirements of the government, its ships, and its war-production plants. But we have likewise exerted every effort to supply the needs of private industry during this national emergency. And nearly always we have *delivered* the FARRIS Safety or Relief Valve required . . . *when* and *where* it was needed.

Oh, yes — priority perplexities, material scarcities, and delivery delays have had us groggy, too! But we have held on to our perspective and vision, and they have enabled us to "deliver the goods." So when you need a safety or relief valve . .

FARRIS Safety Valve No. 2175. Full nozzle port, high lift, high capacity. Steam Separator Bell. For pressures to 600 lbs. at 750° F. Sizes ¾" to 6". Over-size outlet.

ask for a FARRIS!

When you specify a FARRIS Safety or Relief Valve you'll get GOOD DELIVERY — *and a lot more!*

- You'll get a dependable valve, with every finished surface precision machined . . . for precision operation in the protection of your equipment.
- You'll get "precision alignment" of spring, stem, disc, guide, and seat . . . for reliable, trouble-free performance.
- Your FARRIS valve will have fewer parts . . . for reduced risk of failure.
- And it will have sturdy construction, with materials of superior strength and durability . . . for grueling service and long life.

Among the complete lines of FARRIS Safety and Relief Valves there must be the very valve you need — or we'll custom build one to meet your particular requirements! Why not write today for our Bulletin?

Farris

SAFETY and RELIEF VALVES

FARRIS ENGINEERING CO., 366 Commercial Ave., Palisades Park, N. J.

summarizes recommendations of National Patent Planning Comm and shows how protection and incentive for inventors are essential for future American prosperity.

Following three technical bulletins may be obtained through Annular Bearing Engineers Comm, 60 E 42nd St, New York, N. Y., or from Technical Comm, National Lubricating Grease Institute, 164 Chandler St, Buffalo, N. Y. A limited number of Bulletins. 1 and 5 are available at $1 per copy and Bulletin 4 at 50¢ per copy.

TECHNICAL BULLETIN NO. 1 *Pub by Joint Annular Bearing Engineers Comm and National Lubricating Grease Institute.* This booklet is divided into four sections: Part 1 gives a tentative method for determination of low-temperature torque characteristics of greases in antifriction bearings. Part 2 presents the S O D pressure-viscosimeter and Part 3 discusses this meter for low temperatures. Part 4 describes measurement of low temperatures by thermal electric procedures.

TECHNICAL BULLETIN NO. 4 *Prepared for the ABEC-NLGI Cooperative Comm on Lubricating Grease Test Methods by the Subgroup on Norma-Hoffmann Oxidation Test.* Bulletin describes an improved procedure for Norma-Hoffmann bomb oxidation test. This test provides information that will permit predicting behavior of greases in bearings in storage, or in bearings contained in equipment under storage conditions.

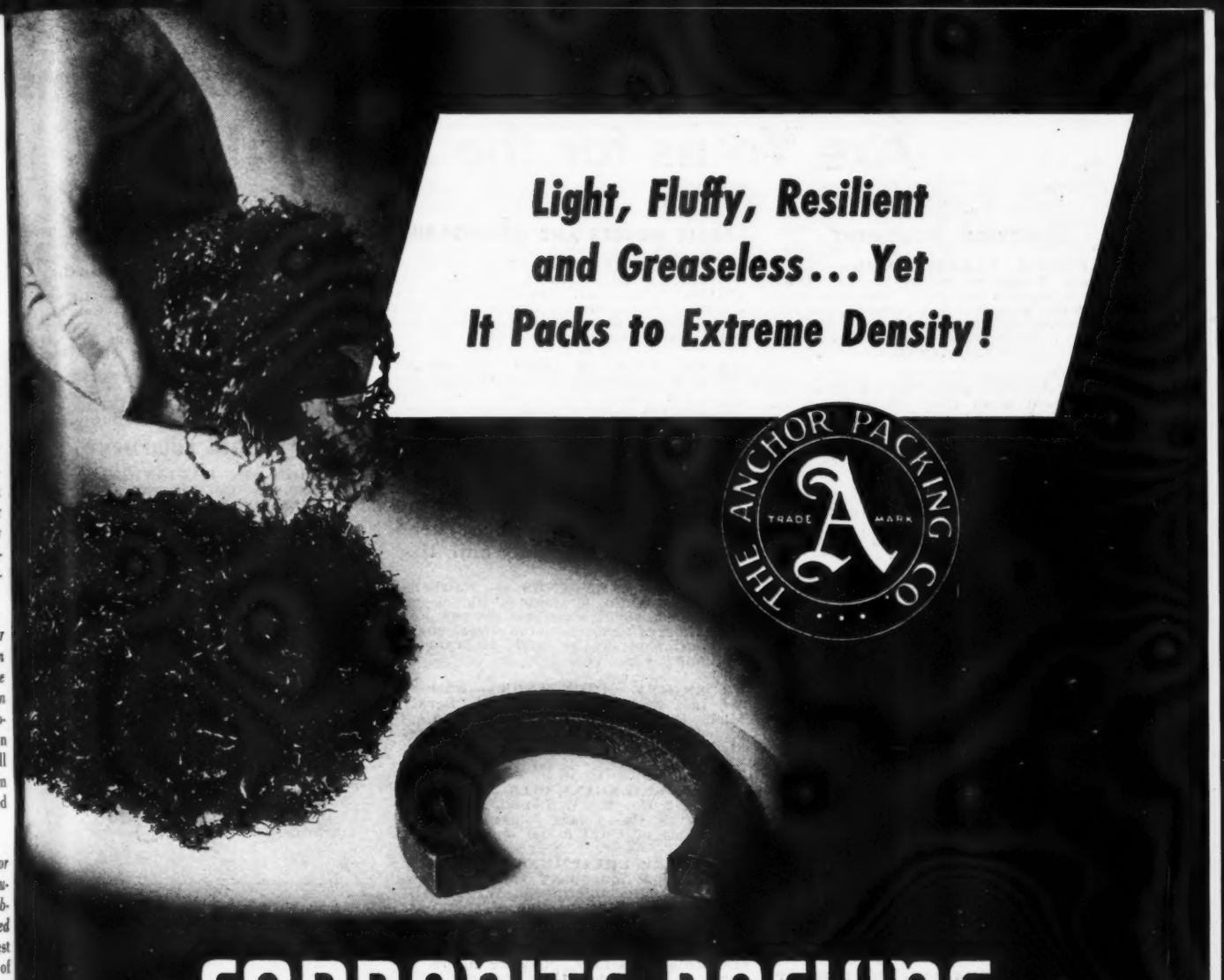
TECHNICAL BULLETIN NO. 5 *Prepared for the ABEC-NLGI Cooperative Comm on Lubricating Grease Test Methods by the Subgroup on Performance Tests at Elevated Temperatures.* Booklet describes a new test apparatus and procedure for evaluation of antifriction bearing greases for high-temperature service conditions.

IMPROVEMENT OF LABOR-UTILIZATION PROCEDURES *Pub by Bureau of Labor Statistics, U. S. Dept of Labor. Available at 10¢ a copy from Supt of Documents, U. S. Government Printing Office, Washington, 25, D. C.* Bulletin No. 807 discusses principles which may be used to increase production and productivity through improvements in labor utilization procedures.

DIESEL FUEL INJECTION SYSTEMS *By Louis R Ford. Pub by Diesel Publications, Inc, 192 Lexington Ave, New York 16, N. Y. 174 pp, $1 in U. S., $1.25 elsewhere.* This book describes in some detail the construction and operating principles of 13 diesel engine injection systems. A chapter is devoted to each system. A final chapter gives hints on servicing fuel injection nozzles.

BITUMINOUS COAL AND LIGNITE *By W R Young, R L Anderson and L H Isaac. Pub by Bureau of Mines, U. S. Dept of Interior 15¢ a copy from Supt of Documents, U. S. Government Printing Office, Washington 25, D. C.* Booklet presents a survey of the bituminous-coal and lignite industry in 1943, the postwar outlook, final bituminous coal and lignite statistics for 1942, statistics on lignite in 1942, imports and exports and world production. This preprint is from a chapter in *Minerals Yearbook*, 194

(*Continued on page* 190)



CARBONITE PACKING

arbonite Packing in coil form! It's easy to use... rings re easily cut... and it's unique in that it contains no il, grease, wax or tar.

ngredients used—asbestos and graphite—will with-tand the highest temperatures of any organic or mineral ubstaaces... can be used in temperatures as high as 50° F. Each fiber is treated with a dry binder, making e packing soft, fluffy and perfectly dry.

Carbonite Packing is recommended for use on centrifugal pump shafts, high or low speed; rotary rods or shafts; reciprocating rods and plungers; expansion joints; valve stems; and numerous other uses against air, oil or water.

There are many advantages in using Carbonite Packing. Write today for these details.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

BRANCH OFFICES

more 2, Maryland	106 Stewart Bldg., Gay and Lombard Streets	Montreal, Canada	5575 Cote Saint Paul Road
on 14, Massachusetts	303-04 North Station Building	Milwaukee 2, Wisconsin	905 E. Kilbourn Avenue
	150 Causeway Street	New Orleans 4, Louisiana	418 Common Street
alo 2, New York	Andrews Building	New York 13, New York	100 Sixth Avenue, near Canal
eland 13, Ohio	523-25-27 Rockefeller Building	Philadelphia 8, Pennsylvania	401 North Broad Street
mbus 9, Ohio	172 North Cassingham Road	Pittsburgh 22, Pennsylvania	405 Penn Avenue
ago 11, Illinois	200 East Illinois Street	Portland 5, Oregon	Terminal Sales Building
nnati 2, Ohio	4 West 7th Street	San Francisco 7, California	156 South Park
it 26, Michigan	169 West Jefferson Avenue	Seattle 4, Washington	2207 First Avenue, South
ton 2, Texas	509 Washington Avenue	St. Louis 3, Missouri	1407 Pine Street
as City 6, Missouri	1332 Oak Street	Tulsa 4, Oklahoma	823 South Gary Place
Angeles 21 California	720 Mateo Street	Wilmington, California	207 Avalon Boulevard

These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

ELECTRICAL EQUIPMENT

1 POWER TRANSFORMERS—Standard Transformer Co, Warren, Ohio. 20-page bulletin No. S-402 discusses modern trends, core and coil elements, ratings, dimensions, weights, specialized designs, standard parts, accessories and applications of power transformers.

2 LIGHTING EQUIPMENT—Fostoria Pressed Steel Corp, Fostoria, Ohio. 4-page folder and single catalog sheet describe Localite models which are available by assembling standard component parts of bases, arms and reflectors.

3 GENERATORS—Kato Engineering Co., Mankato, Minn. 12-page bulletin discusses Katolight ac generators. Capacities, weights, dimensions and prices are included.

4 ELECTRONIC HEATERS—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 4-page bulletin No. B6372 covers application of vacuum-tube electronic heaters for both induction heating of metals and dielectric heating of nonmetallic materials.

5 MERCURY ARC CONVERTERS—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 8-page bulletin No. B6373 presents standard mercury arc converters for induction heating operations in the 500 to 2000 cycle frequency range.

PIPING, FITTINGS VALVES AND SPECIALTIES

6 DIAPHRAGM REGULATING VALVES—Leslie Co., Lyndhurst, N. J. 4-page bulletin No. 406 gives reference tables and data for use in engineering computations, sizing regulators and diaphragm regulating valves.

7 VALVE RESEATING EQUIPMENT—Leavitt Machine Co, Orange, Mass. 32-page operating manual and parts list covers Globe valve reseating equipment.

8 WHISTLES AND SIGNALS—Leslie Co, Lyndhurst, N. J. 12-page bulletin No. 421 outlines selection, construction, operation and installation of Leslie-Tyfon whistles and signals. Applications, advantages, specifications and dimensions are included.

PRIME MOVERS AND ACCESSORIES

9 DIESEL ENGINES—Cleveland Diesel Engine Div, General Motors Corp, Cleveland 11, Ohio. 32-page booklet explains construction of Series 268A main and auxiliary diesel engines. Colored photographs of equipment are included.

10 SILENCER AND SPARK-ARRESTER—Sims Co, P O Box 1096, Erie, Pa. 4-page bulletin discusses Sims-Whittington silencer and spark-arrester for internal-combustion engines.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **DIESEL ENGINES**—Fairbanks, Morse & Co, Chicago 5, Ill. 32-page bulletin No. 3800D describes the new Fairbanks-Morse opposed-piston diesel engine. Colored photographs and diagrams of equipment are given.

11 ENGINE MOUNTINGS—Bushings, Inc, 3442 W 11 Mile Rd, Berkley, Mich. Bulletin No. BU-23 contains a simplified means of selecting rubber insulated engine mountings for stopping engine vibration.

12 DIESEL ENGINE OILS—E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa. 4-page folder gives characteristics of Vital diesel engine oils.

13 POWER EQUIPMENT—Worthington Pump & Machinery Corp, Harrison, N. J. 48-page bulletin No. WP-1099-B13 discusses Worthington line of steam turbines, surface condensers, circulating pumps, steam-jet ejectors, condensate pumps, relief valves, hydraulic tube washers, water softeners, pressure filters, deaerators and deaerating heaters, boiler-feed pumps, heater drain pumps, air compressors, centrifugal pumps, meters, etc.

WELDING

14 ARC WELDING—Lincoln Electric Co, Cleveland 1, Ohio. 20-page booklet, entitled "101 Welding Ideas for Low-Cost Maintenance," points out profitable applications of Shield-Arc welding in a wide variety of industries.

15 WELDING UNIT—Victor Equipment Co, 844 Folsom St, San Francisco 7, Calif. 46-page form No. 1 tells how to assemble a welding or cutting outfit.

16 WELDING FILTER LENSES—American Optical Co, Southbridge, Mass. New reference chart points out proper shades of filter lenses to wear for different types of welding operations.

17 ARC WELDING PROCESS—Lincoln Electric Co, Cleveland 1, Ohio. 26-page booklet presents the Lincolnweld, an automatic shielded arc welding process.

OTHER EQUIPMENT

18 IRON-FIN RADIATION—D J Murray Mfg Co, Wausau, Wis. 6-page folder describes design and construction of cast-iron fin radiation.

19 INSULATING FIREBRICK—Harbison-Walker Refractories Co, 1800 Farmers Bank Bldg., Pittsburgh 22, Pa. 14-page folder discusses five insulating firebricks of prime importance to refractory users.

20 SOOT BLOWERS—Marion Machine, Foundry & Supply Co, Marion, Ind. 24-page bulletin introduces Type F automatic-valve balanced-head soot blower. Rear section covers other soot blowers.

21 PUMP GOVERNORS—Leslie Co, Lyndhurst, N. J. 12-page bulletin No. 403 gives selection, construction, installation and application of pump governors. Pressure ranges, sizes, capacities and dimensions are included.

(*Continued on page* 188)

HOW TO ORDER

Be sure to fill out, completely one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

Use as many coupons as you need, but cut them out and send them as one block in an envelope addressed to POWER, 330 W. 42nd St., New York 18, N. Y. Only requests made on these coupons will be honored.

FILL OUT AND SEND TODAY! NOT GOOD AFTER SEPT. 1, 1945

Write in circle number of item describing one catalog wanted →

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 18, N. Y. 6/45

Write in circle number of item describing one catalog wanted →

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 18, N. Y. 6/45

Write in circle number of item describing one catalog wanted →

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 18, N. Y. 6/45

Write in circle number of item describing one catalog wanted →

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 18, N. Y. 6/45

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co

Address 3718 First Avenue

Pottsville, Oklahoma

Your Name John Smith

Your Title Power Engineer

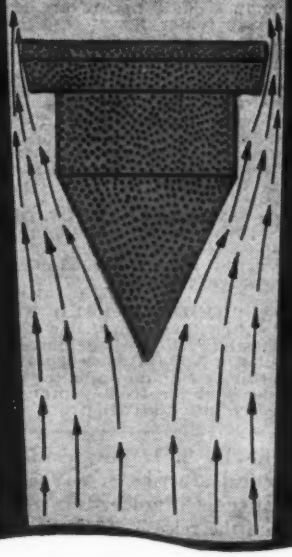
POWER, 330 West 42nd St., New York 18, N. Y.

The ROTAMETER

—its basic advantages over head-type meters

8 BASIC ADVANTAGES

1. Metering elements and fluid being metered clearly visible
2. Wide flow range—20-to-1 easily obtained
3. Evenly spaced scale divisions—no compression of scale at low flows
4. Low, constant pressure drop—reduces pumping costs
5. New Stabil-Vis rotameter compensates for viscosity and density variations
6. 10" to 24" travel of metering float—accuracies correspondingly high
7. Instantaneous response to flow change—no friction or hysterisis
8. Measures corrosive gases, liquids and slurries that no other meter will handle accurately



Are you trying to cut power costs? Are you seeking stable process conditions? Do you sometimes operate with precious little available head? Silly questions! Of course, you do, and therefore we would like you to consider the

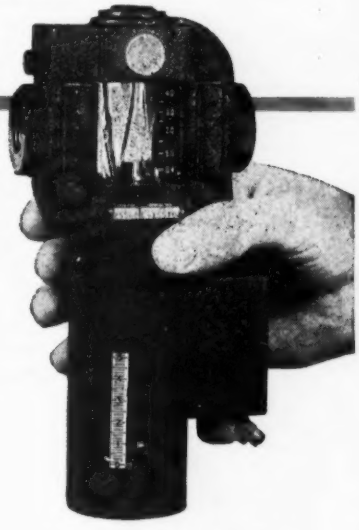
Low and constant pressure drop

of the rotameter. As the rotameter float rises, the area for flow passage increases so that the flow never has a fixed constriction thru which to force its way.

The pressure drop across the float is low and constant throughout the entire flow range of the rotameter.

Consequently in many plants Fischer & Porter Rotameters are definitely paying their way thru lowered pumping costs, and doing their gentle bit to keep touchy processes quietly soothed by a minimum of pressure fluctuations. Often they are the only meters that may be used because of the low total pressure available.

Do you know all the advantages that are making Fischer & Porter Rotameters *the* flow rate measuring instrument? Our new booklet, "A New Era in Flow Rate Measurement," will tell you why. It's very comprehensive yet "awfully" easy to read because it's done in a semi-humorous, "catch-as-catch-can" cartoon style which we hope will appeal to you. It's free, so why not send for it?



NEW FLOW ALARM . . . positive . . . inexpensive

The float in the Rota-Sight alarm moves up or down in direct proportion to flow rate changes. At any points you may choose in the flow range it will operate an electrical switch to light an electric lamp, to sound an alarm, or to stop or start electrical equipment. Positive . . . accurate . . . dependable. Cast in all metals from ¼" size and up. Available also without the alarm attachment as a flow rate indicator. Send for bulletin 92-A which gives the interesting details.

FISCHER & PORTER CO.

6006 COUNTY LINE ROAD, HATBORO, PA.

FLOW RATE INDICATING, RECORDING OR CONTROLLING ROTAMETERS FOR ANY LIQUID OR GAS

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and
. . . you'll use it always

THE ALLPAX CO., INC.
Mamaroneck, N. Y.

Distributors Everywhere

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all — economically, efficiently — tightly — simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

YOU CAN BUILD YOUR OWN TUBE CLEANERS

Have you ever wished that you had the facilities available to build your own tube-cleaners for special or unusual jobs? The chances are you can do just this—and do it easily too.

You can do it by selecting one of the numerous motors and one of the many cutter-heads from the large assortment of Wilson Tube Cleaners and parts that are available.

A copy of the Wilson Tube Cleaners Check-List will help you make this selection, and thus help solve your tube-cleaning problems. It shows various Wilson Tube Cleaners for practically every type of deposit in straight or curved tubes—tube cleaners that get the job done faster!

The Check-List also contains valuable information on operation and maintenance of tube cleaners. Your copy will be sent on request—and without obligation.

wilson

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK

New Bulletins

(*Continued from page* 186)

22 ELECTRONIC CONTROLS—Wheelco Instruments Co, Harrison & Peoria Sts, Chicago, Ill. 12-page bulletin No. Z6300 describes indicating pyrometers and pyrometer controllers, indicating resistance thermometers and resistance thermometer controllers, input controllers, program controllers, portable potentiometers, combustion safeguards and thermocouples.

23 HEAT-TRANSFER EQUIPMENT—Whitlock Mfg. Co, 48 South St, Hartford 1, Conn. 16-page bulletin No. 645 discusses heat transfer equipment, including shell and tube and coil designs.

24 TUBE CLEANER—Lagonda Div, Elliott Co, Springfield, Ohio. 4-page folder No. Y-19 on the 1300 series tube cleaner features a cutaway view of the motor, an exploded view of its simple assembly and an illustration of its operation.

25 SOLDERING TOOLS — Ideal Commutator Dresser Co, 1292 Park Ave, Sycamore, Ill. 4-page leaflet describes the Thermo-Grip electric soldering tools.

26 WATERPROOFING MATERIAL — Flexrock Co, Filbert & Cuthbert, Philadelphia 4, Pa. Folder presents Flextite, a liquid that stops leaks when mixed with cement or cement and sand.

27 ACIDPROOF CEMENTS — Quigley Co, 527 Fifth Ave, New York 17, N. Y. 8-page bulletin No. AP122 features Quigley acidproof cements for bonding and repairing acid-resisting masonry structures. Folder outlines Quigley line and distributors in the U.S.

28 RUN-AROUND CONVEYOR—Link Belt Co, 307 N Michigan Ave, Chicago 9, Ill. 8-page, folder No. 2068 explains the Sidekar-Karrier, a new run-around conveyor.

29 BELT HOOKS—Mill Supply Div, Bristol Co, Waterbury 91, Conn. Bulletin describes new line of wire belt hooks for flat belting. This folder also shows method of applying hooks to belts.

30 VARIABLE-SPEED CONTROL — Standard Products Div, Worthington Pump & Machinery Corp, Harrison, N. J. 6-page folder No. V-1400-B10A gives advantages and applications of Worthington Allspeed Drives.

31 PUMPS—Goulds Pumps, Inc, Seneca Falls, N. Y. 38-page booklet, entitled "Goulds Pumps at War," explains why this company was unable to make deliveries of pumps for commercial purposes. Booklet tells of importance of pumps to the war effort.

39 HYDRAULIC-PRESSURE PUMPS—Warren Steam Pump Co, Warren, Mass. 4-page bulletin No. 238 describes Warren duplex forged-barrel hydraulic-pressure pumps.

33 CHEMICAL FEED SYSTEMS—Milton Roy Pumps, 1300 E Mermaid Ave, Chestnut Hill, Philadelphia 18, Pa. 4-page bulletin No. 451 describes two systems for feeding sodium sulphite into feedwater lines and for feeding other chemicals directly into the boilers.

The U. S. is now confronted with a critical shortage of engineers, Dean A A Potter of Purdue University announced, with the release of a survey made by Purdue. Of 105 companies replying, 92.4% reported a total need of 4590 engineers. "This would indicate that the total need by American industry of fully trained engineers is certainly many times the shortage reported," said Dean Potter. "This is particularly serious, since the output of civilian engineers from all engineering colleges of the U.S. during the present year will be less than 2000 and will be made up largely of individuals who are physically incapacitated."

Watch a Gal do up her Hair-Springs

ONE OF THE REASONS 6 OUT OF 10 PICK U. S. GAUGES

A FUSSY-PLUS JOB IN GAUGE MAKING

Such is the importance and care required in making hair springs for gauges that U. S. Gauge entrusts the work only to its own operators. The fine, barely visible wire, is rolled flat to micrometric tolerances, coiled, and tempered.

These steps, completed in our own plant, are—to our knowledge—exclusive with U. S. Gauge.

WHY 6 OUT OF 10 CHOOSE U. S. GAUGE

Sure, making our own hair springs is important. But it is only one of many similar steps in U. S. Gauge-making you can reduce to two words—*Manufacturing Control.* U. S. Gauge Manufacturing Control is the eye-everywhere that watches raw materials, manufacturing, assembling, calibration, testing and inspection. It's all reasons rolled into one why experienced buyers choose U. S. Gauge more than 6 out of 10 times.

US Gauges

← WATCH FOR LARGEST, MOST COMPLETE GAUGE CATALOG EVER PUBLISHED!

Whatever your product or industry, you should have at your elbow the new 102 Page U. S. Gauge catalog. An encyclopedia of gauges, gauge movements, and gauge manufacture. Streamlined to save you time in finding and reading. Special pull-out guide makes ordering easy. Reserve your copy (no obligation) on your business letterhead, please.

DEFT FINGERS, yes. But the story of U. S Gauge hair springs is also one of hair's breadth accuracy in die making and temperature control.

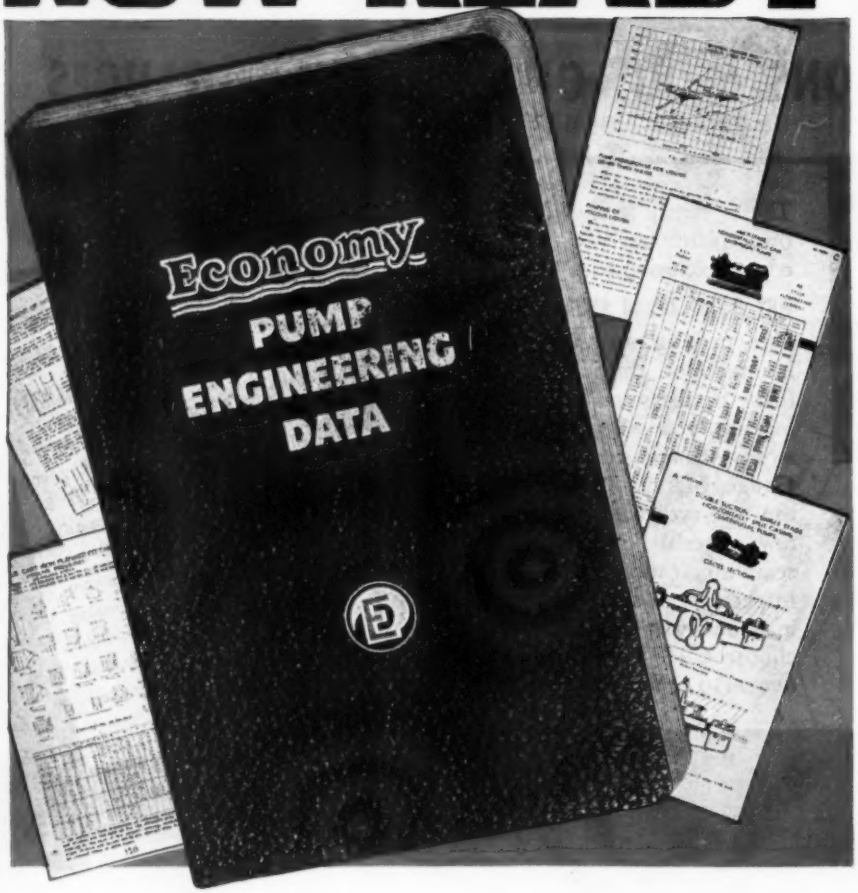
UNITED STATES GAUGE CO.

SELLERSVILLE, PA.

Manufacturers of Pressure, Temperature, Flow, Electrical and Level Measuring Instruments

USG U.S. INSTRUMENTS Tell The Truth

NOW READY



GIVES YOU THE ANSWERS TO PUMP-ENGINEERING PROBLEMS

A timely contribution to the pump industry—416 pages of factual data just when vital postwar problems require authentic facts, sound experience and advanced engineering practice.

Here, under one cover, are hundreds of handy tables and diagrams you need every day. Revised, improved and new data governing the correct layout and installation of sewage, drainage, processing, heating systems, etc. Describes clearly and exactly the way to do the job right.

Indispensable to Executives, Engineers, Plant Managers, Maintenance Men, etc. Sent free in response to requests on business letterheads.

If your copy is delayed in reaching you, we're sorry, and ask your indulgence. The unprecedented demand temporarily exceeded the manpower for handling—but all requests received to date are being filled in rotation.

WRITE FOR YOUR COPY!

ECONOMY PUMPS, INC.
HAMILTON, OHIO • U. S. A.
FOR OVER THIRTY YEARS MAKING BETTER PUMPS DO MORE

Booklet Reviews

(*Continued from page* 184)

FUNDAMENTALS OF MAGNETO IGNITION *Pub by Magneto Div, Fairbanks, Morse & Co, Beloit Works, Beloit, Wis.* 64 *pp, illustrated,* $1. Book features such subjects as definition of magneto, its general purposes, magnetism and electricity, ignition requirements, early ignition systems, magneto design and construction, application of magneto ignition, impulse couplings and magneto service practices.

GI's OPPORTUNITY *Available from Adventures in Business, Knott's Berry Pl, Buena Park, Calif.* 64 *pp,* 25¢. Written to guide and inspire returning service men as they prepare to build new careers on the home front, this collection of true life stories of successful business men will certainly accomplish its purpose. Each of the men listed has carved his own way in the field of American free enterprise.

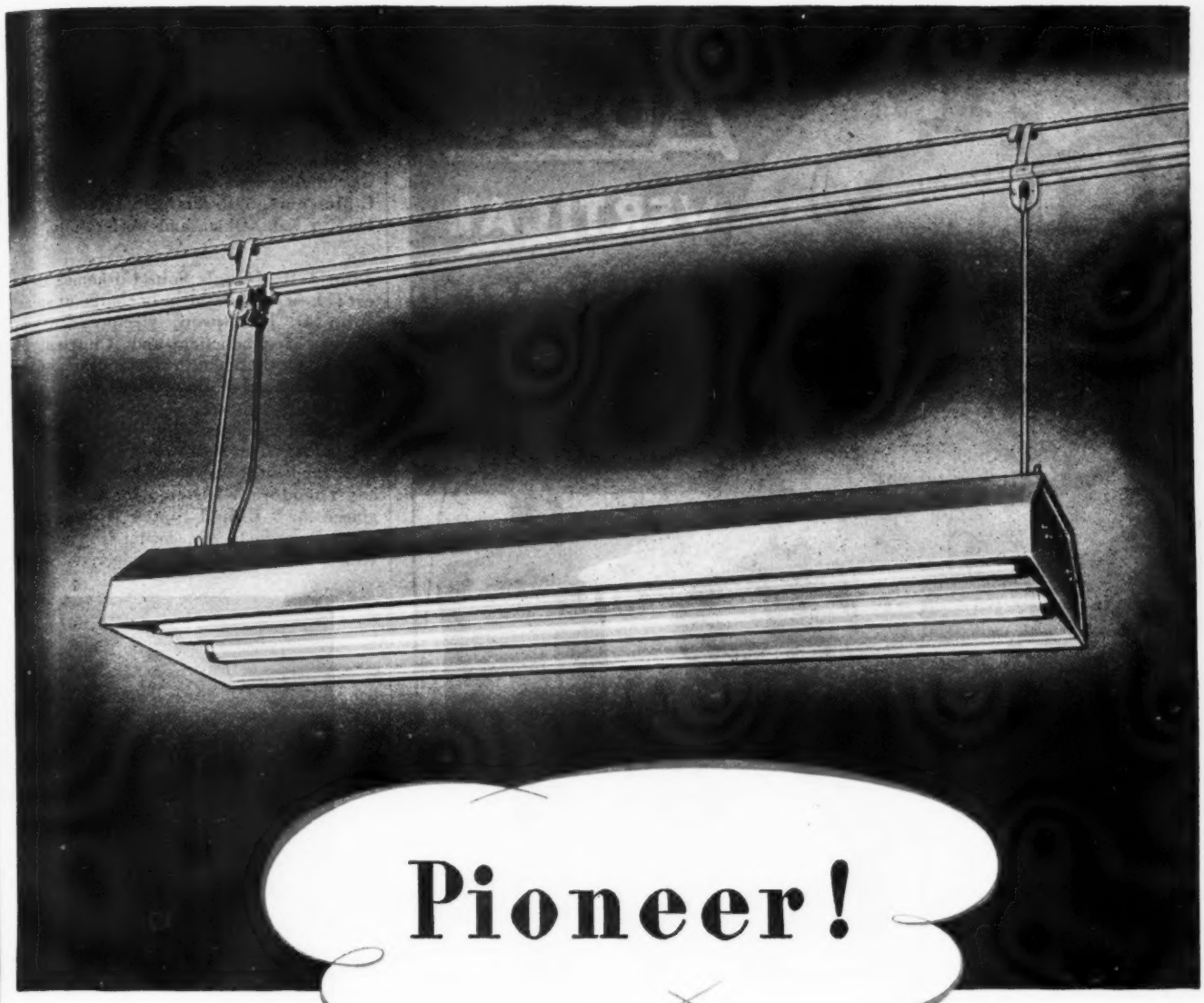
APPOINTMENTS

General Electric Co announces appointment of **J. J. Huether** as assistant manager of industrial divisions and **W A Wirene** as manager of industrial materials division. **R C Sogge** has been named assistant manager of GE central station divisions. **Dudley E Chambers** becomes executive engineer of research laboratory. He succeeds **Dr Laurence A Hawkins** who retires. GE establishes air-conditioning dept as one of six major operating dept. This dept is to be at Bloomfield, N. J., with **George R Prout** general manager.

B F Goodrich Co has named **Harold W Rehfeld** factory manager of new government tire plant in Tuscaloosa, Ala. Establishment of **B F Goodrich Chemical Co,** a division of B F Goodrich Co, with offices and laboratories in Cleveland, Ohio, and mfg plants in Ohio, N. Y., and Ky., has been announced. **William S Richardson** becomes president of the chemical company. **Gardner-Denver Co** elects **Alfred Kauffmann** a director.

Warren Steam Pump Co appoints **C E Johnson & Associates,** 401 Bona Allen bldg, Atlanta, Ga., as sales representatives in Ga., eastern Tenn., northern Ala. and eastern Fla. . . . **Fairbanks, Morse & Co** has named **John S King** manager of pump div . . . **Bristol Co** has made **C E Mason** technical director . . . **R E Broyles** has been appointed commercial manager of new branch office and warehouse of **Graybar Electric Co** at 1310 Agnes St, Corpus Christi, Tex.

Babcock & Wilcox Co appoints **Alfred Iddles** and **J H King** vice-presidents. Mr Iddles' duties will be extended to include supervision of certain engineering activities and Mr King will continue as head of marine dept . . . **Foster Wheeler Corp** elects **William L Martwick, Lee A Swem**



Pioneer!

BULLDOG UNIVERSAL TROL-E-DUCT

For Completely Flexible Lighting

A thoroughly modern, flexible system of factory lighting pioneered by BullDog—already proved in vital war industries!

Light where it is needed—close to the job—helps both production *quality* and production *quantity*. With BullDog Universal Trol-E-Duct, you can add new lights or re-locate present ones without re-wiring — immediately and wherever needed.

You can even move the whole system anywhere in your plant to accommodate changes in production set-ups. It is prefabricated and built in standard sections—100% salvable, too, nothing to scrap.

Investigate Universal Trol-E-Duct for *your* plant. Adaptable to any type of lighting—fluorescent, mercury vapor or incandescent. Consult expert BullDog field engineers, or write for descriptive folders.

BUY WAR BONDS

BULLDOG

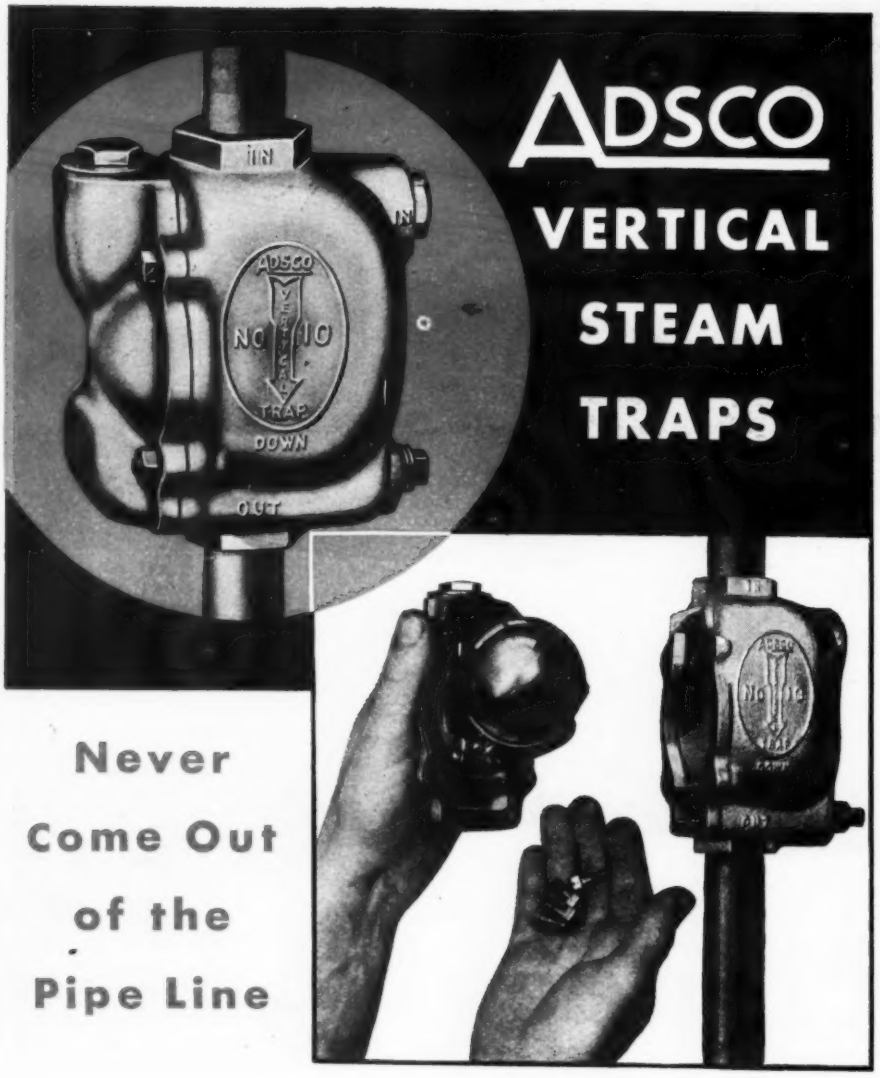
ELECTRIC PRODUCTS COMPANY

SALVAGE PAPER

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities.

Also Manufacturers of

Vacu-Break Safety Switches—SafToFuse Panelboards—Switchboards—Circuit Master Breakers — BUStribution DUCT, for "plug-in" power—Industrial Trol-E-Duct, for movable "loads."



All working parts attached to cover

So light that it can be borne entirely by the piping — with valve and float mechanism mounted on cover, and all piping connections on the body, the Adsco Vertical Steam Trap need never come out of the pipe line.

If cleaning or adjustments are necessary the cover with all working parts can be removed quickly without disturbing the piping. By keeping an extra cover with valve assembly on hand this "spare" can be substituted in a few minutes with practically no interruption to service, and the original assembly taken to the work shop for servicing.

DOUBLE LIFE. This trap also has a reversible valve and reversible seat of non-corrosive stainless alloy steel which gives it double life. Write for Bulletin No. 35-86 PR and prices.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of "UP-TO-DATE" Steam Line Equipment For Over 65 Years

and Charles E McCulloch as directors to board . . . **American Engineering Co** appointed three additional sales agents: **Milton G Brown,** 1847 E 28th St, Minneapolis 7, Minn., will represent co in Minn., N.D., S.D. and northwestern Wis.; **J J O'Shea,** 305 Techwood Dr, N W, Atlanta, Ga., in Ala., Fla., Ga. and S. C.; **Thomas C Messplay,** 5916 McGee St, Kansas City, Mo., in Kan., Okla., and western Mo.

John A Roebling's Sons Co names **Ernest C Low** vice-president in charge of sales, **John D Thompson,** vice-president in charge of production and **Charles M Jones,** vice-president in charge of engineering. **Archibald W Brown** has been elected a member of board of directors . . . **Wickwire Spencer Metallurgical Corp** announced that **Armon N French** has been appointed assistant sales manager and **Theodore A Havens, Jr,** tungsten engineer . . . **United States Rubber Co,** general products div, made **Howard W Kelsey** sales promotion manager.

Frank S Hecox

Iron Fireman Mfg Co announces following changes: **Frank S Hecox** becomes vice-president, treasurer and director; **C T Burg,** vice-president in charge of sales; **Omar C Spencer,** director, replacing E C Sammons; and **Clifford W Snider,** secretary. Other officials in the organization set-up are **Mansel P Griffiths** and **T Henry Boyd,** directors. Omar C Spencer will also serve as assistant secretary.

Westinghouse Electric & Mfg. Co changed name to **Westinghouse Electric Corp. George G Main** has been elected assistant treasurer and assistant secretary. He will also act as credit manager. **W E Lee** of Los Angeles application engineering dept is transferred to Phoenix, Ariz., as application engineer. **Lee C Bennett** becomes central station manager of Middle Atlantic district, succeeding William P Cochran. He will also retain position of marine engineer for this district. **Patrick W Cross** has been appointed manager of Sao Paulo office of Westinghouse Co of Brazil and **W W Parker** regional engineer in Rio de Janeiro.

Westinghouse Electric Corp elects **Ellis L Spray** vice-president in charge of elevator and air-conditioning activities at Jersey City. **Westinghouse Electric Elevator Co** has been dissolved as a corporate

For HOT SPOTS use "Nasbestus"

WIRES and CABLES

A name to remember for installations where heat, flame, oil, moisture, grease and corrosive fumes prevail, and where rubber, Neon (thermoplastic) and varnished cambric insulations are unsuitable.

Illustrated are two examples from our wide range of asbestos and asbestos-varnished cambric insulated wires and cables. Literature and complete engineering data on request.

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES

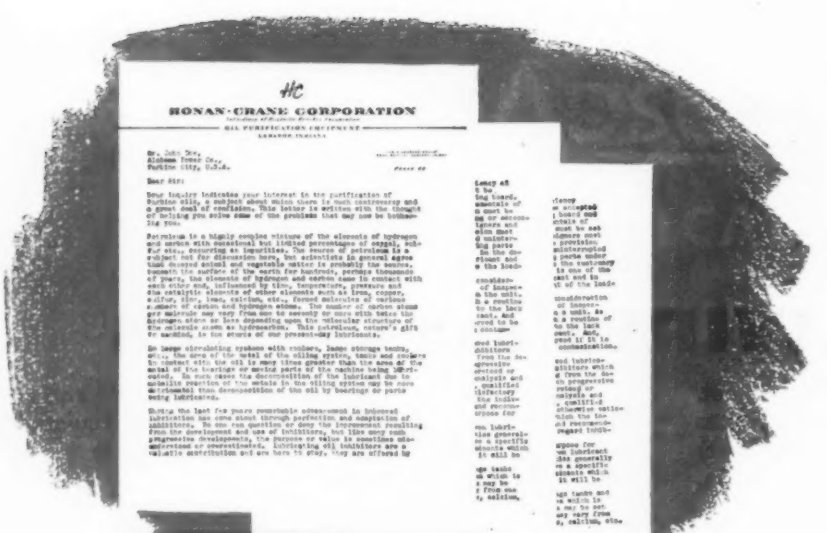
ALL ASBESTOS WIRE AND CABLE

Sizes No. 18AWG to 1,000,000 CM.—For wiring rheostats, stoves, switchboards and electrical equipment exposed to heat or fire hazard. Also for general open wiring in hot locations. 300 and 600 volt ratings. Max. operating temperatures 200°C (392°F) and 125°C (257°F) respectively.

ASBESTOS-VARNISHED CAMBRIC CABLE

Sizes No. 18AWG to 1,000,000 CM.—For power circuits and general hot spot wiring in boiler rooms, steam tunnels, etc. 600 to 8000 volt ratings. Max. operating temperatures 110°C (230°F) and 91°C (196°F) respectively.

National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.


HONAN-CRANE CORPORATION

AN OPEN LETTER TO TURBINE OPERATORS

from

BEN F. HUNTER
Honan-Crane Corporation
Consulting Engineer

THERE IS TODAY much controversy and a great deal of confusion about the use of Fullers Earth for purification of turbine oils containing additives such as rust and oxidation inhibitors.

To clear up this confusion and conflict of opinion, Ben F. Hunter, Honan-Crane Consulting Engineer, has prepared an open letter to turbine operators which answers many of the questions most frequently raised and explains why Fullers Earth should be and CAN BE SATISFACTORILY EMPLOYED ON OILS CONTAINING INHIBITORS. It is yours for the asking.

In this three-page, single-spaced letter Mr. Hunter discusses fully and with directness, "rust inhibitors" and "oxidation inhibitors", steam emulsion and neutralization numbers as well as general performance of the turbine. He also explains the function of various inhibitors, what they are, how they work and how they are affected by Fullers Earth purification.

Mr. Hunter, previous to January, 1945, spent 19 years as chief lubrication engineer for the Gulf Oil Corporation and the Gulf Refining Company, and was closely associated with the development of additives in turbine oils.

In his open letter Mr. Hunter answers the questions you—the turbine operator—most frequently ask. His judgment is based on long experience and close contact with the problems of purifying oil containing additives.

• Fill in the coupon below and mail today for your copy of Mr. Hunter's "Open Letter"

HONAN-CRANE CORPORATION
Subsidiary of Houdaille-Hershey Corporation
1200 SIXTH STREET LEBANON, INDIANA

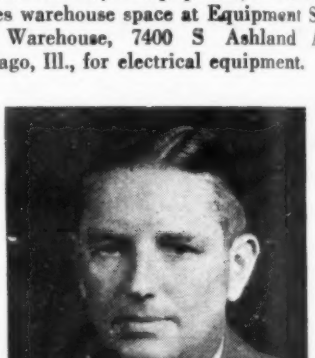
Without obligation on my part, please send me Ben F. Hunter's "Open Letter to Turbine Operators."

Name.....

City.....Zone.....State.....

entity and will continue as elevator and air-conditioning divisions. **Ross Rathbun** will continue as manager of air-conditioning div and **Walker G White** as manager of elevator div. **Westinghouse Electric Supply Co** names **William S Cowan** farm sales manager of Northwestern district, with headquarters at Chicago. **R H Elliott** has been appointed district apparatus and supplies manager, with headquarters in Philadelphia.

Corning Glass Works made following changes in technical products and bulb and tubing divisions: **Edward C Leibig** has been promoted to position of assistant to director of glass technology; **Justin J Pfeiffer** has been advanced to manager of mfg for technical products div; and **D Kenneth Shaddock** succeeds Mr Pfeiffer as plant manager . . . **Freyn Engrg Co** moves to 58 E Washington St, Chicago 2, Ill. . . . **Electric Equipment Co** purchases a building at 1026 Niagara St, Buffalo, N. Y., which will be operated as a warehouse for cycle equipment, and also acquires warehouse space at Equipment Storage Warehouse, 7400 S Ashland Ave, Chicago, Ill., for electrical equipment.



Thomas Robins, Jr

Robins Conveyors, Inc, appoints Thomas **Robins, Jr,** president, succeeding Thomas Matchett, who is retiring . . . **Magnus Chemical Co,** water treatment and marine service div, has made L W **Anthony,** Hollywood, Calif., manager of Southwest territory; **R D Richardson,** Tacoma, Wash., Northwest district manager, covering Ore., Wash. and northwestern Mont. and Idaho; **C H Ingalls,** Providence, R. I., Northeast agent . . . **W & Taylor & Co** announces that **Dr G E Miller** will become actively associated with the company . . . **Russell Lang** joins **Hall Laboratories** field service staff at Los Angeles, under Ray Sullivan.

Graver Tank & Mfg Co has placed N **Graham** in charge of water treating and process equipment sales in Tampa, Fla, area . . . **Briggs Clarifier Co** has appointed **E Digges La Touche** to administer field service engrg staff of aviation div. He is also responsible for development of foreign markets for Briggs aircraft ground clarifiers. **Mack Sales,** 425 E Platt St, Tampa, becomes distributor for company in Fla . . . **Crane Co** elected **P Mork** executive vice-president and J

Pumping Problems

CONTACT PACIFIC

- BRAINS TO THINK THROUGH
- BACKING TO CARRY THROUGH

Whatever your pumping problems may be, PACIFIC Engineers will have the answer.

Whether you hold priorities to buy now or are planning future requirements, you are interested in one thing — trouble-free pumping service — pushing fluid through, efficiently and economically, under the conditions that prevail in your sphere of operations. New and expanding production, new processes make new demands on flow equipment.

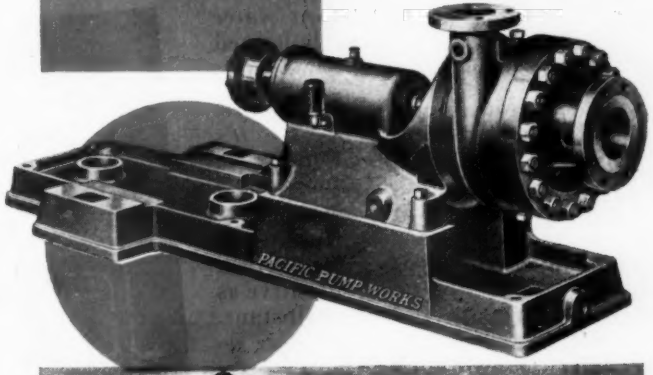
Anticipating this, Pacific Engineers developed the finest and most complete line of precision pumps known. Pumps that meet every conceivable variation in pumping conditions. Pumps that defy temperatures, chemicals, acids and whatnot. Exclusive features that give long years of service with low maintenance, in plants around the globe.

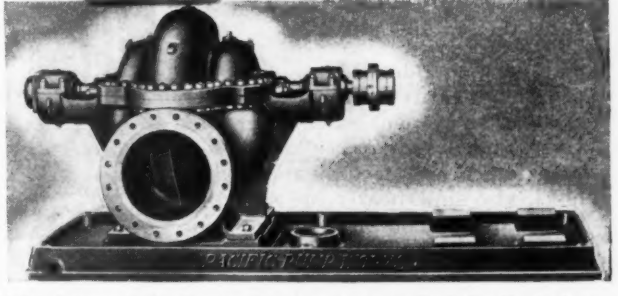
PACIFIC Engineers have the brains and backing to carry through!

PACIFIC PUMP WORKS

Executive Offices and Plant: Huntington Park, California • *Export Office:* 30 Rockefeller Plaza, New York • *Sales and Service:* Offices in principal cities in the United States • *Affiliated Companies:* Dresser Manufacturing Co., Bradford, Pa.; Clark Bros. Co., Inc., Olean, N. Y.; The Bryant Heater Co., Cleveland; O.; Van der Horst Corp. of America, Cleveland, O., Olean, N. Y.; Bovaird & Seyfang Mfg. Co., Bradford, Pa.; Dresser Manufacturing Co., Ltd., Toronto, Ont., Canada.

PACIFIC Type SEMB—Single-Stage Vertically-Split Centrifugal Pump.





PACIFIC Type DMB—Double Suction, Horizontally-Split, Single-Stage Centrifugal Pump.

PACIFIC *Engineered* PUMPS

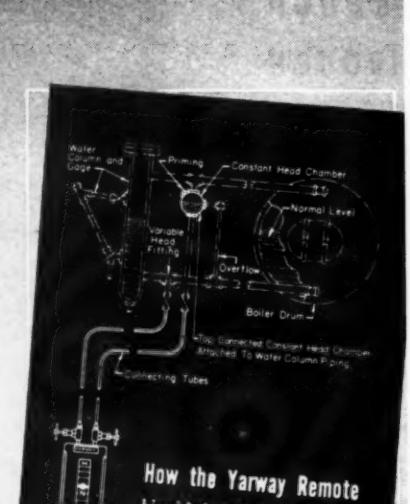
ACCURATE READINGS

AT EYE LEVEL

Here's the boiler water level indicator you've been looking for—a dependable, fool-proof instrument that gives accurate, instant water level readings on a brilliantly-lighted scale right in front of your eyes.

The Yarway Remote Liquid Level Indicator is accurate because *it's operated by the boiler water itself*—by the pressure differential between a constant head of water and the varying head in the boiler drum . . . a unique indicating mechanism which is never under pressure. "Positive as the law of gravity." Action is instant, constant, frictionless. *There are no stuffing boxes.* Suitable for all pressures up to 1500 psi.

The Yarway Indicator is moderately priced and easily installed on new or existing equipment. (See diagram.) Over 2000 already in use . . . to indicate boiler and feed heater water level, also superheater pressure differential. For complete description, ask for Bulletin WG-1820.



How the Yarway Remote Liquid Level Indicator is installed.

YARNALL-WARING COMPANY, 100 Mermaid Ave., Phila. 18, Pa.

YARWAY REMOTE LIQUID LEVEL INDICATOR

Dwyer vice-president in charge of sales. **Lucien W Moore** has been made general manager of sales and branch houses and **F J Wilkey** manager of valve and fitting dept.

Manning, Maxwell & Moore has made **William T O'Connor** vice-president in charge of purchases . . . **Diamond Iron Works, Inc,** and **Mahr Mfg Co,** div, Minneapolis, announces appointment of **John A Goundrey** as works manager . . . **Tracy V Buckwalter** retires as chief engineer and vice-president of **Timken Roller Bearing Co,** but will act in a consulting capacity for company. **Kieley & Mueller, Inc,** appoints **Jno D Hiles Co,** Plaza Bldg, Pittsburgh, Pa., as agents in that area.

C S Herbert has been elected executive vice-president of **Enterprise Engine & Foundry Co** and will direct engine process machinery and combustion equipment divisions. Mr Herbert is also secretary-treasurer of firm. Other officers elected are: **G J Panario,** chairman of board; **C P Hoehn,** president; **H C McKenna,** controller and assistant secretary; and **R E Kroeck,** assistant secretary . . . **F E Millan** has been made sales manager of Ridgway div, **Elliott Co** . . . **Monsanto Chemical Co** appointed **Dr Charles Allen Thomas** vice-president and announced that, effective Sept. 1, he will become a member of executive committee.

Jones & Laughlin Steel Corp makes following appointments: **J O'H Anderson** and **H B Spackman** to assistant general managers of sales; **V A Jevon** to be in charge of Pittsburgh district sales office; **C T Hapgood** to manager of sales, tubular products; **E W Harwell** to district sales manager, Philadelphia office; **L C Berkey** to district sales manager, Chicago office; **C C Wehling** to St. Louis district sales manager. District office of Jones & Laughlin Steel Corp and Jones & Laughlin Supply Co moved to 135 S LaSalle St, Chicago 3, Ill.

Southern California Edison Co, Ltd, elects **William C Mullendore** president and **Harry J Bauer** chairman of board . . . **Ernest E Dubry** has been made superintendent of central heating dept of **Detroit Edison,** succeeding **J Herbert Walker,** who was recently elected a vice-president. **Rudolph G Felger** was made assistant superintendent in charge of plants and coaling stations and **Glenn D Winans** assistant superintendent in charge of steam distribution and customer relations. **Chester F Ogden** returns to Detroit Edison from which he was on loan to OWU. **O L Hooper** replaces him as head of the Conservation Branch. . . . **Buffalo, Niagara & Eastern Power Corp** promoted **Dr Norman R Gibson** to senior vice-president and **Edwin S Bundy** to chief electrical engineer and vice-president. Company also elected **Albert T O'Neill** and **Arthur W Jackson** vice-presidents.

J Robert Van Pelt has joined **Battelle Memorial Institute** staff and will assume responsibility for an expanded program of research education . . . **Westcott &**

In Byron Jackson High Pressure Boiler Feed Pumps DOUBLE VOLUTE DESIGN *Eliminates* RADIAL THRUST

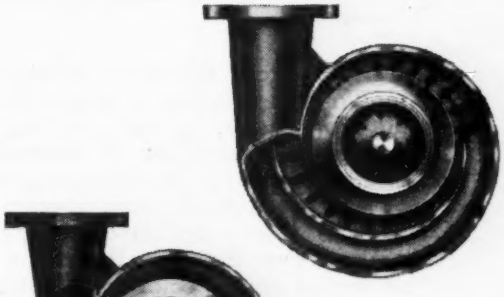
Cross section HSB and HDB Byron Jackson Boiler Feed Pumps showing how radial balance is achieved by double volute design.

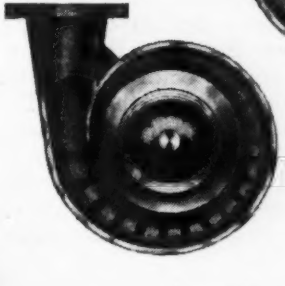
Boiler feed pumps must operate over a wide load range. At low capacities, single volute pumps develop great radial forces which lead to excessive shaft deflections, resulting in objectionable wear and sometimes to fatigue stresses that cause ultimate shaft failure.

To overcome such action, in Byron Jackson Double Case Pumps these radial pressure loads are balanced out completely by the use of Double Volute Inner Cases. Each volute is divided into two identical fluid channels in the plane of the impeller, with outlets 180° apart, resulting in opposed forces of equal magnitude and radial balance without pressure bending moment on the shaft at any capacity.

Capacity range of the Type HSB pump is from 100,000 to 400,000 pounds per hour. Type HDB is from 350,000 to 1,000,000 pounds per hour. Pressure range of both types is from 1,000 to 2,000 psi. in standard designs.

The benefits of our accumulated experience in designing pumps for high pressures and temperatures is available to you upon request.





(ABOVE LEFT)
Single volute, illustrating the unequal distribution of forces between intake and discharge points.

(ABOVE RIGHT)
Double volute, showing the equality of opposing forces at any given point of the entire circumference.

ARMY E NAVY

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

DAVIS PRESSURE REGULATORS

. . . custom made for ANY job!

● *Left: Davis No. 401 Pilot-operated Regulator.*

● *Left, Below: Davis No. 16 Diaphragm actuated, Weight Loaded Regulator.*

✓18 Different Types . . . Sizes to 24 Inches

✓For Steam, Air, Oil, Gas, Water...Pressures to 1500 lbs.

✓Spring or Weight Loaded

To obtain maximum efficiency in your pressure regulator installation, it is absolutely essential to have the proper valve for each application. Pressure reduction requirements are as dissimilar as finger prints, and solution of these often-complex problems requires proper size, capacity and operating characteristics, as well as proper design and dependable construction.

The Davis Pressure Regulator line is COMPLETE; no matter how special the application, Davis builds a regulator that will do the job. Every Davis product is constructed and tested to meet the requirements of each individual order.

Davis engineers can solve your pressure reduction problem quickly and efficiently. Literature and selection charts prepared in easy-to-use form are yours for the asking.

For additional information, write today for Bulletin 100 A.

DAVIS REGULATOR COMPANY
2540 S. Washtenaw Ave., Chicago, 8, Ill.

DAVIS VALVES

DAVIS REGULATOR COMPANY

Mapes, Inc, will be located at 109 Church St, New Haven, Conn . . . **National** headquarters of **American Society of Refrigerating Engineers** moved to 40 W 40th St, New York, 18 . . . **Robert E Cochran,** former editor of *The Highway Traveler* magazine, has been appointed resident editor in Cleveland for McGraw-Hill publications.

CURRENT AWARDS

Electric Storage Battery Co and elevator div of **Westinghouse Electric Corp** received five stars for their "E" flags. Industrial electronics and X-ray div of Westinghouse and **Warren Webster & Co** have been awarded four stars.

Maxim Silencer Co, Div 1 of **Stewart-Warner Corp** and **Alliance gun mount** plant of **Babcock & Wilcox Co** have received three stars for their "E" flags.

Cooper-Bessemer Corp, Grove City plant, has been awarded a second star for its "E" flag. **Walter Kidde & Co** and **Glenn L Martin Co** have been given Army-Navy "E" flags.

Edward Valve & Mfg. Co has received fifth gold star for its Maritime "M" pennant. **Homestead Valve Mfg Co** and **Edwards & Co** have been awarded four gold stars for their Maritime "M" pennant. Passaic plant of Manhattan rubber mfg div of **Raybestos-Manhattan, Inc,** received the National Security Award.

OBITUARIES

Walter Ewing Miller, 81, former vice-president, treasurer and director of Fairbanks, Morse & Co and director of Canadian-Fairbanks-Morse Co, Ltd, died recently in Chicago.

Hans Nielsen Boetcher, 47, assistant to superintendent of power production stations dept, Consolidated Gas Electric Light & Power Co of Baltimore, died April 19.

Charles H Eastwood, general advertising manager of Wallace & Tiernan and Associated Companies, died April 27.

Robert M Sanford, 56, manufacturing superintendent of Monsanto Chemical Co's plant at Monsanto, Ill., died April 24.

Stewart Mulholland, 53, auditor for Public Utilities Commission of N.Y., died recently at a Harrisonburg, Va., hospital.

Fred J Taylor, 95, for 22 years chief engineer at the Westboro State Hospital until his retirement in 1929, died at his home in Upton, Mass., on April 20.

Joseph Garfield Worker, 64, senior engineer for the Redistribution Div of WPB, died recently. He was formerly sales manager and director of American Engrg Co of Philadelphia and had been associated with Westinghouse Electric Corp before entering government work several years ago.

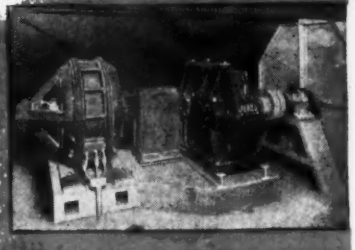
Chester H Thordarson, 78, active head of Thordarson Electric Mfg Co until his retirement to an advisory capacity a few years ago, died recently in Chicago.

Warren Tubbs, chief counsel for Buffalo Niagara & Eastern Power Corp and for its operating companies, died April 2 in Buffalo General Hospital.

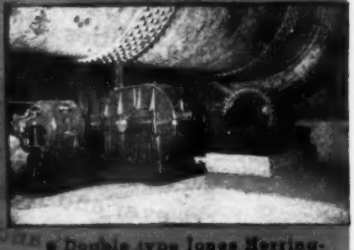
Jones HERRINGBONE SPEED REDUCERS

Catalog No. 70 of Jones Herringbone Reducers presents a vast amount of data relating to Herringbone Reduction Units. Illustrations show a broad range of herringbone reducer applications, and technical information shows how to select reducers for all conditions of service in accordance with the A.G.M.A. recommended practice.

• This view of a Jones Triple Reduction Herringbone Speed Reducer typifies a line that is noted for advanced design, superior materials and precision workmanship.



• Jones Reducer on a cement mill elevator head shaft drive.



• Double type Jones Herringbone Speed Reducer driving kiln in cement plant.

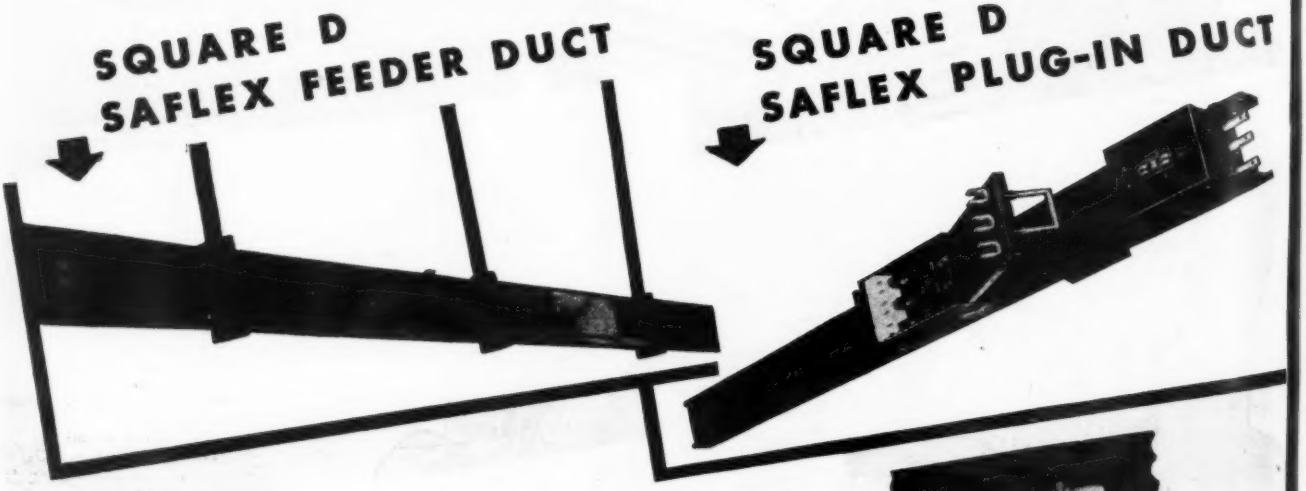
• Jones Speed Reducer on a feeder drive in cement mill.

JONES Herringbone Gear Speed Reducers are built in a wide range of ratios and ratings to cover every requirement. Single (Type SH) reducers in standard ratios range from 1.25 to 1 up to 11 to 1 in ratings from 1.3 to 440 H.P. Double (Type DH) reducers are built in standard ratios from 10.9 to 1 up to 72 to 1 in ratings from 0.5 to 275 H.P. The triple reduction reducers (Type TH) cover a range of ratios from 86.9 to 1 up to 355.8 to 1 in ratings from 0.3 to 78 H.P.

All these reducers have heat treated gears, ground shafts and are mounted with anti-friction bearings throughout. Cast Iron bases are available for all variations of motor assembly.

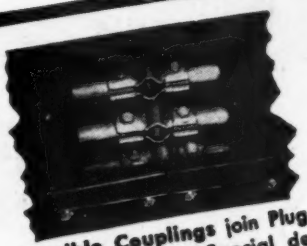
W. A. JONES FOUNDRY & MACHINE CO.
4423 Roosevelt Road, Chicago, Illinois

FOR EFFICIENT POWER DISTRIBUTION



Square D Saflex Feeder Duct is designed to serve as the feeder between transformer banks and main switchboard or as feeders to branch circuits where minimum voltage loss is essential. Because of its low reactance and consequent balanced low voltage drop (1.8 volts per 100 feet) it is ideally suited for welder circuits —enables conductor size to be kept at a minimum. Feeder duct is available in standard 10-foot sections with special fittings to meet all types of installations. WPB sizes of 800, 1000, 1350 and 2000 ampere capacities.

Square D Plug-In Duct is a perfect running mate for Feeder Duct. It permits plugging-in machines whenever and wherever they are needed. Units are easily attached and disconnected. 100% salvage for re-use. Available in 250, 400 and 600 ampere capacities.



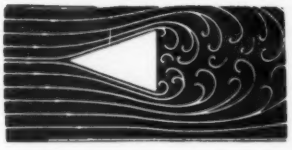
Flexible Couplings join Plug-In-Duct bus bars. Special design permits expansion or contraction to be absorbed at the joint, and also provides flexible connections for correction of minor variations in bus alignment. Notice use of round tubular buses which afford highest possible mechanical strength when subjected to heavy short circuit stresses.

Units Easy to Attach. Hook-type bracket on top of plug-in unit attaches to top of duct. Unit is then swung down and jaws snap into position on bus bars—tightened securely with a single screw—on or off in a jiffy. 10 units may be attached to each 10′ section.

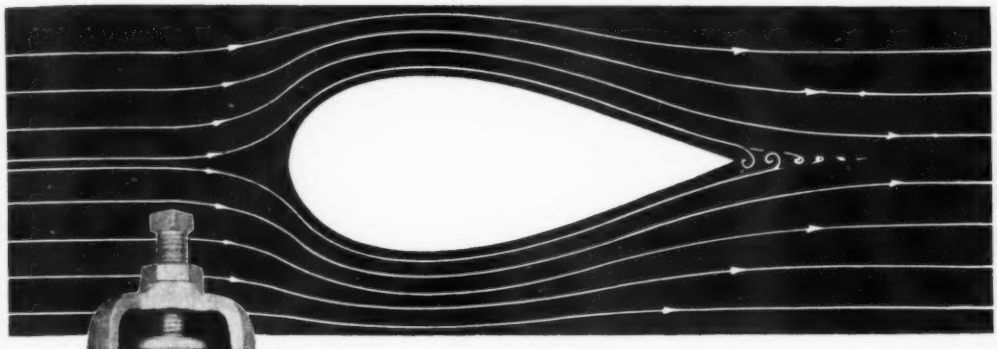
SQUARE D COMPANY

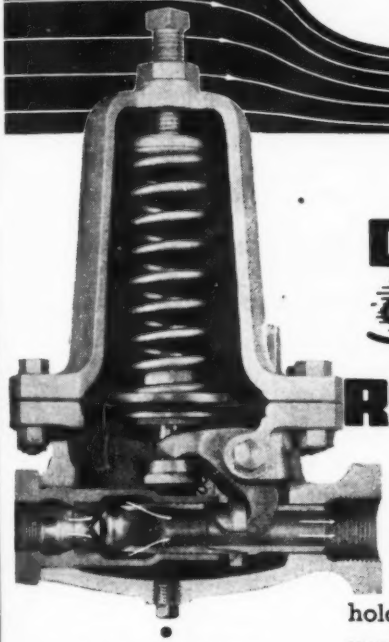
DETROIT • MILWAUKEE • LOS ANGELES

Nothing is in the path of flow to cause turbulence like this . . . . . .



You get this Streamlined pattern





CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

Streamlined flow of steam, water, air, oil, etc. from inlet to outlet of this "1000" valve, gives you many operating advantages such as enabling you to meet peak demand and still hold the pressure constant. You get the exact flow you require at all times. Operation is smoother and the "1000" performs without flow variation.

Among the net results of this straight line flow are improved operation, a definite cut in maintenance, prevention of spoilage, and higher product quality.

Send for Bulletin "1000"

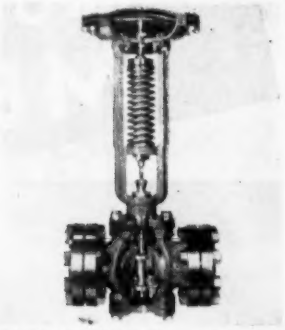
This bulletin presents a detailed story on the design and operation of the "1000" valve. It shows how Streamlined flow prevents turbulence and tells why the Streamliner is an all-around cost-saver.

- EXTRA LARGE CAPACITY
- TIGHT CLOSING CHARACTERISTICS
- CLOSE DELIVERY PRESSURE CONTROL
- WIDE RANGE OF ADJUSTMENT

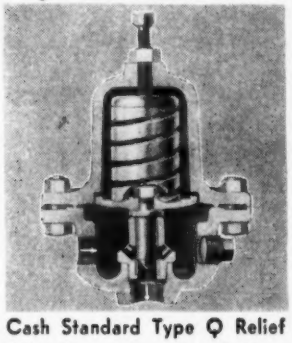
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

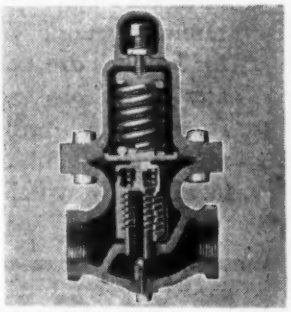
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.



Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump by-pass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.



Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.

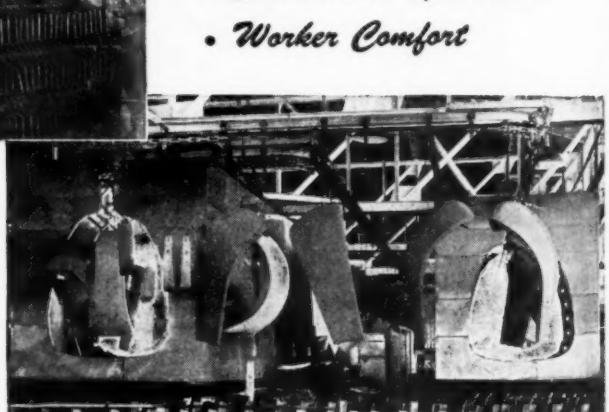
☆

MANAGEMENT —PRODUCTION MEN!

—SPEED —REDUCE *of Baking*

PROVEN BENEFITS OF THE EVENRAY SYSTEM

- *Saves Time*
- *Saves Floor Space*
- *Reduces Rejects*
- *Instant Production*
- *No Stand-by Loss*
- *Visible Operation*
- *Greater Flexibility*
- *Economical Operation*
- *Worker Comfort*



Over 3,000 Fostoria Installations Prove Benefits in Small and Large Operations

Pictured here is a Fostoria installation in the plant of a large automotive manufacturer. The Infrared tunnels, through which painted parts are conveyed for baking, are suspended from the ceiling. This saves valuable floor space for storage or other use. Here, Infrared reduced finish-baking time from 55 minutes to 8½ minutes. Processing starts and stops instantly by switch controls.

FOSTORIA INDUSTRIAL

Specialists in the Application of Near Infrared

THE FOSTORIA INDUSTRIAL SERVICE FORMULA FOR APPLYING INFRARED ENERGY

Study of problem and pretesting for solution

+

Calculation of installation required

+

Supervision of Installation

+

YOUR PRODUCTION OPERATING COSTS

-Drying-Dehydrating-Preheating

Among new industrial methods, Infrared heating stands out as a development of great contribution to faster, better and lower cost production. On baking, drying, dehydrating and preheating operations, processing time reduction of 50% and more is common. In many installations, production has been doubled and tripled without increased floor space. Savings in labor and operating costs are also substantial with remarkable results of improved production on both large and small operations. These and other important benefits make investigation of this new tool imperative NOW to management—production men —either for present or postwar production.

For discussion of the utilization of Infrared, review of case histories applicable to your operations, and inspection of Fostoria Evenray Systems, call one of the Fostoria Industrial Service Centers listed below. This nationwide organization of specialists provides the experience of over 3,000 highly successful installations and the comprehensive technical facilities necessary to pretest and forecast accurately the benefits of Infrared for your specific use.

REQUEST THIS FREE BOOKLET, TODAY

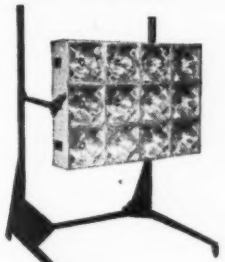
Includes fundamental information about Infrared and the advantages of Fostoria Evenray Systems.

Case history information applicable to your operations will be included if you send us general facts about your baking, drying, dehydrating or preheating problem.

Catalog of portable equipment also available on request.

PORTABLE MODELS

Also available in Fostoria Evenray Equipment



In addition to Evenray Systems designed to meet any requirement for tunnel contour and size, portable models are available in standard types for specific uses.

Highest Efficiency in the Utilization of INFRARED RADIANT ENERGY

EVENRAY SYSTEM

fostoria

FOR BAKING • DRYING • PREHEATING • DEHYDRATING

Trade Mark
Reg U S Pat Off

SERVICE

Radiant Energy

= SUCCESSFUL OPERATION

After-installation service

THE FOSTORIA PRESSED STEEL CORPORATION • FOSTORIA, OHIO

Independently Affiliated Manufacturers
Southern Industries, Atlanta, Ga.
Amalgamated Electric Corp., Ltd., Toronto, Canada

Export Sales Dept.
401 Broadway
New York City

LOCATIONS OF FOSTORIA INDUSTRIAL SERVICE CENTERS

ATLANTA
140 Marietta St., N. W.
Main 2757

BOSTON
620 Commonwealth Ave.
Commonwealth 0333

BUFFALO
404 North Oak St.
Lafayette 8135

CHATTANOOGA
1021 Chestnut St.
Phone 6-6194

CHICAGO
747 W. Jackson Blvd.
Randolph 5942

CLEVELAND
4500 Euclid Ave.
Endicott 6622

DAYTON
334 Wayne St.
Fulton 3594

DETROIT
12171 Grand River Ave.
Hogarth 1850

INDIANAPOLIS
548 Massachusetts Ave.
Riley 2934

LOS ANGELES
1206 Maple Ave.
Prospect 7761

MILWAUKEE
104 East Mason St.
Daly 2949

MINNEAPOLIS
2 Foshay Tower
Atlantic 7363

NEW HAVEN
(Hamden, Conn.)
1240 Whitney Ave.
Phone 2-5985

NEW YORK
92 Warren St.
Worth 2-3352

OAKLAND
205 Twelfth St.
Twin Oaks 4475

OMAHA
1102 Farnam St.
Atlantic 5540

PHILADELPHIA
(Bala-Cynwd, Pa.)
349 Montgomery Ave.
Greenwood 4477

PITTSBURGH
5339 Penn Ave.
Highland 9900

ST. LOUIS
1706 Olive St.
Central 0153

SEATTLE
90 Dearborn St.
Main 0919

CANADA: Montreal • Toronto
Northern Electric Co., Ltd.

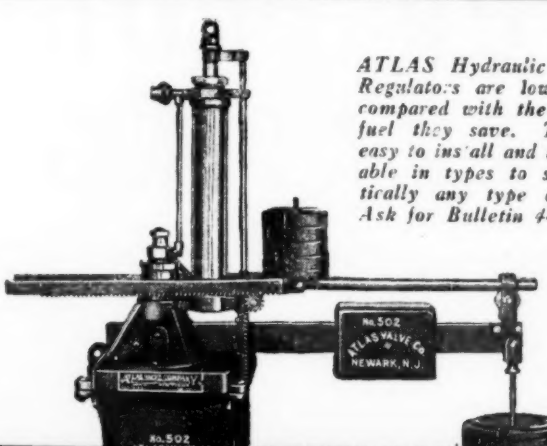
DANGER! RUST AT WORK

Rust works silently and often unseen—but it's costing you money and man-hours. You can STOP IT! Tectyl—easily applied by spraying, dipping, brushing, or flushing—*seals* metal surfaces against any possibility of corrosion. Tectyl is economical to use, protects for as long as two years, and can be removed quickly and cleanly with kerosene.

There is a* TECTYL *Product for every rust problem

VALVOLINE OIL COMPANY
431 Main St., Dept. 29 F, Cincinnati 2, Ohio
Refinery at Butler, Pennsylvania
General Offices, Cincinnati, Ohio
New York - Atlanta - Detroit - Chicago - Los Angeles
Vancouver - Washington, D. C.

TECTYL
STOPS RUST



ATLAS Hydraulic Damper Regulators are low in cost compared with the value of fuel they save. They are easy to install and are available in types to suit practically any type of boiler. Ask for Bulletin 4-A.

ATLAS Damper Regulators

...provide sensitive maintenance of desired steam pressures

By proper and automatic adjustment of boiler drafts and dampers, ATLAS Damper Regulators keep CO_2 where it should be. CO is avoided. Fuel is saved and flue gas temperatures are kept down where they belong for maximum operating efficiency.

On forced draft boilers ATLAS Regulators may be arranged to control fan speed. From the fan they can be made to indirectly regulate feed rate of stokers.

AUTOMATIC HYDRAULIC OPERATION REPLACES HAND ADJUSTMENT

By utilizing water pressure acting on a piston which is connected to draft doors or dampers by chain, ample power is available for moving the heaviest doors or dampers. At the same time the control piston responds to slightest variations in steam pressure so that uniform pressure is maintained through closest adjustment of dampers and a resulting steady rate of combustion.

Low Pressure No. 501

Suitable for automatically regulating drafts of vapor or low pressure steam heating boilers. Can be adjusted to operate at any steam pressure up to 25 pounds.

Medium Pressure No. 502

Shown above. For boiler pressures up to 150 lb. Will move damper on boiler pressure changes of ¼ lb.

High Pressure No. 503

Cast Iron Base construction for boiler pressures up to 250 lb.; Cast Steel Base construction for boiler pressures up to 400 lb. Will move damper on ½ lb. boiler pressure variations.

PRINCIPAL ATLAS PRODUCTS

Check the items below on which you want information and mail to us with your name, firm name and address.

- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ CAMPELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Float Valves
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

Specialists in Regulation for Nearly a Half Century

289 South St., Newark 5, N. J.

Representatives in Principal Cities

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

Planned Flexibility

THE contractors on this building were foresighted. They planned an electrical conduit system that would provide maximum flexibility for all future wiring needs --and they installed Youngstown BUCKEYE CONDUIT, as this picture shows.

For maximum flexibility in YOUR new post-war wiring jobs, or in jobs replacing wartime emergency wiring, install full-weight rigid steel conduit in such a way as to anticipate all possible future needs and changes.

Youngstown's BUCKEYE CONDUIT, installed in any building, provides a permanent, safe and easy method of increasing or varying wiring circuits at any future time. In fact, BUCKEYE CONDUIT outlasts the buildings in which it is used and gives complete protection against short circuiting or arcing from vibration, dirt, dust, moisture, or corrosion. In exposed spots its rigid, full-weight steel walls protect against crushing or other mechanical damage.

BUCKEYE CONDUIT is preferred by electrical contractors in all parts of the country for its unvarying quality and strength. It will soon be available at all distributors again.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

Ask your distributor for: Youngstown Buckeye Conduit...Pipe and Tubular Products...Sheets...Plates...Electrolytic Tin Plate...Coke Tin Plate...Bars...Rods...Wire...Nails...Tie Plates and Spikes.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

HOLD IT!

YOU'LL get along with *less* of that precious fuel if you'll stop wasting heat *up-the-stack.* Do this: Measure the CO_2 in your flue gases with the Ranarex* instrument. Adjust combustion till the percentage of CO_2 is exactly at the point known to be correct for your load. Then you're getting *all* the power possible from the fuel you burn.

Ranarex gives instant, accurate readings. It contains no chemicals or fragile parts to get out of order.

Write for free bulletin to The Permutit Co., Dept. A, 330 W. 42nd St., New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal. *Trademark Reg. U. S. Pat. Off.

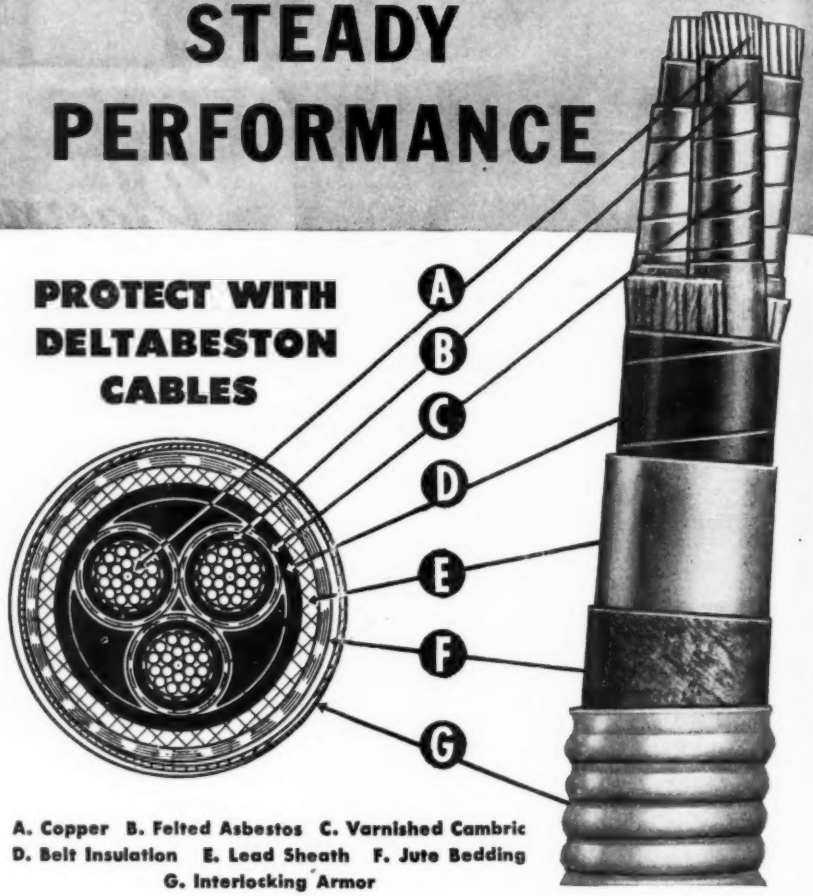
SAVE FUEL WITH

RANAREX

product of
PERMUTIT

Insure STEADY PERFORMANCE

PROTECT WITH DELTABESTON CABLES



A. Copper B. Felted Asbestos C. Varnished Cambric
D. Belt Insulation E. Lead Sheath F. Jute Bedding
G. Interlocking Armor

One of the safest ways to insure steady performance in circuits that run around boiler rooms, steam tunnels, furnaces and other severe operating places is to protect with G-E Deltabeston Asbestos-insulated Cables. Unexpected cable failures in power, lighting or control circuits can make your plant lose production and profits. Why take unnecessary risks? Make an inspection trip around your power plant, check the torrid zones where heat, moisture and corrosive vapors are busy at their destructive work and rewire with Deltabeston Asbestos-insulated Cables.

The Deltabeston product shown here is a three-conductor power cable with lead sheath, jute bedding and interlocking armor. It was designed for a central station to handle high current densities, during peak load periods. It has fine resistance to high ambient temperatures. It's flame-proof and physically tough. The armor takes the place of rigid conduit and gives the cable the same protection. Construction without interlocking armor or jute bedding can be supplied. Also available with asbestos braid instead of lead sheath. There's a Deltabeston Cable for every installation where heat, flame, moisture, oil, grease and corrosive vapors are a problem.

For additional information write to Section Y655-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. Deltabeston Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp., and other G-E Merchandise Distributors.

Buy War Bonds and Keep Them

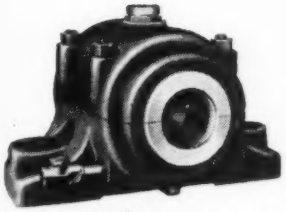
GENERAL ELECTRIC

WHAT DODGE HAS DONE ABOUT THE WEATHER

Dodge has helped take the uncertainty out of indoor climate, by providing weather makers with a *quiet* precision bearing which combines exceptional load-carrying capacity with *dependability*.

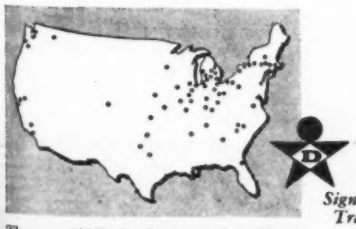
The requirements of air conditioning equipment are exacting and specialized. Dodge worked closely with equipment makers to analyze the bearing problem—then applied Dodge experience and Transmissioneering skill to the solution. As a result, Dodge Sleevoil Precision Bearings carry the power load in many vital war-time installations. These dependable bearings will be important in the vastly expanded role of air conditioning after the war.

The Dodge Sleevoil is a ring oiling, babbited bearing that serves many purposes. It is also available with water cooling for applications where elevated temperatures are encountered. Call the Dodge Transmissioneer—your local Dodge Distributor—for complete information about this and other new developments in power transmission equipment.



DODGE SLEEVOIL PRECISION BEARING

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA, U. S. A.



There are 210 Dodge factory graduate Transmissioneers, located in principal cities, to show you new and better ways of transmitting power.

Sign of the Dodge Transmissioneer

DODGE
MISHAWAKA

Copyright 1945 Dodge Mfg. Corporation

JEFFERSON
Specialty
UNIONS

with the RECESSED BRASS SEAT

MAKE BETTER PIPING INSTALLATIONS POSSIBLE

Jefferson Union Tees with a union on the run are available with pipe ends threaded either All-Female or Male and Female. By being used wherever a union is desired near a tee, they provide the means of assuring outstanding improvement in piping installations.

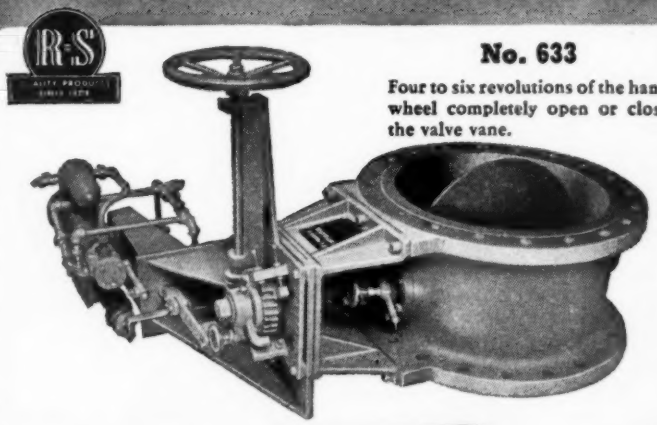
All Jefferson Specialty Unions feature the Jefferson Recessed Brass Seat, which, located in a recess away from the runway of the fitting, cannot be dislodged regardless of how far pipe ends are screwed into the fitting.

•

Complete details on Jefferson Unions are available from us or your nearest distributor.

JEFFERSON UNION CO.

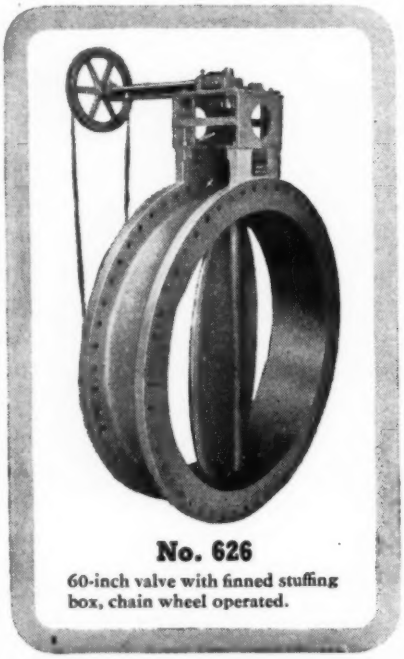
601 W. 26th St., New York 1, N.Y.
Factories at
LEXINGTON 72, MASS.
LOCKPORT, N. Y.



No. 633
Four to six revolutions of the hand wheel completely open or close the valve vane.

RUGGED
150-Pound Valve
Better Built Than 300-pound Steel Standard

This R-S 150-pound All-Steel Butterfly Valve, with the exception of the 150-pound raised face flanges, is actually better built than a 300-pound steel standard. Body, vane, shafts, keys, bushings and bearings far exceed 150-pound ASA requirements. Such rugged construction outlasts 150-pound pipe fittings.



No. 626
60-inch valve with finned stuffing box, chain wheel operated.

Equipment consists of a 300-pound hydraulic cylinder with zero to 15 psi positioner, heavy-duty hand wheel, self-locking worm and gear and declutching unit.

A paramount feature of all R-S Butterfly Valves is the fact that the flow "fans out" into a crescent-shaped spray when the vane approaches a closed position. Wear is not confined to one small surface with a consequent weakening of the valve wall when abrasive materials are handled.

Write for details and Catalog No. 14-B.

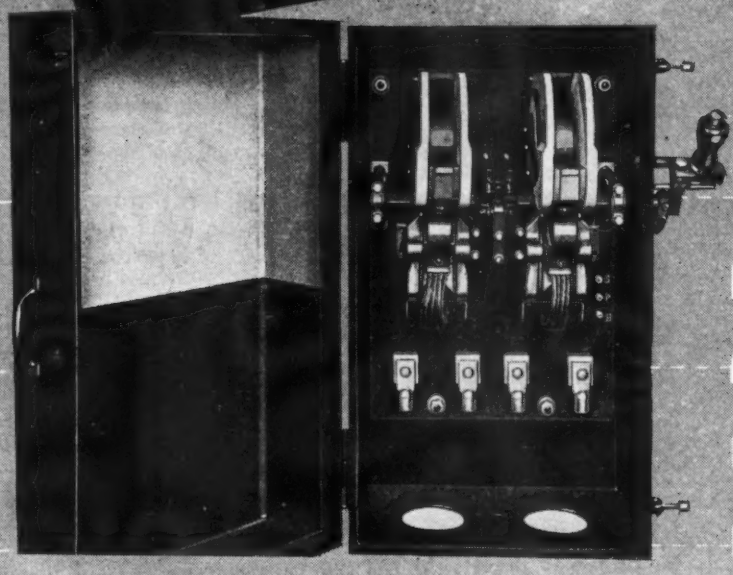
• 15 to 900 psi •

Control and shut-off of volume and pressure for air, gas, steam, liquids and semi-solids.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Ave. • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

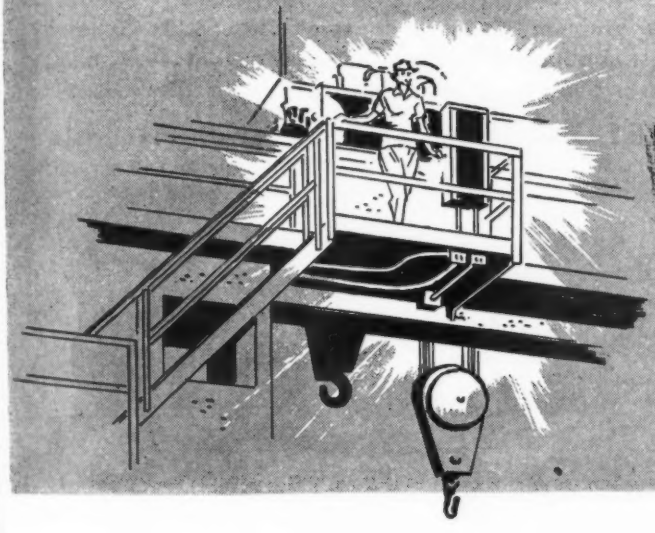
new Safety Disconnect Switch for D-c Cranes



1 Manual-magnetic type for ease of operation.

2 LINE-ARC design for high arc-rupturing ability.

3 Designed with parts associated with crane control to reduce the replacement-part problem.



● Safety rules in many industrial plants and laws in several states require a safety disconnect switch on overhead traveling cranes, mounted at the point where the operator enters or leaves the crane. These switches disconnect the crane from the main collector power-feeders running along the crane runway.

Previously, operators, especially women, have had difficulty in opening and closing disconnect switches of the manually operated type.

This new EC&M *Magnetic Type* Disconnect Switch meets all the requirements of ease of operation, safety, convenience and reliability. It is of double pole design, completely enclosed and has side-type, externally-operated handle with thumb-latch which holds handle in either open or closed position. Pushing the handle up, closes the switch, pulling it down opens it—a cam roller forces contacts open, if necessary, and also insures against accidental closure due to vibration or an impact blow from another crane on the same runway. It allows for up to three padlocks for locking switch open.

New publication 1024, just issued, gives complete data on ratings, sizes, dimensions, etc. Copy will be mailed promptly upon receipt of your request.

E&M

THE ELECTRIC CONTROLLER & MANUFACTURING CO.

2698 EAST 79th STREET • CLEVELAND 4, OHIO

Watch SOOT Disappear

FIRE-SCALE and FLY-ASH DROP OFF

Dry out the adhering binder with

SAVERITE

SOOT ELIMINATOR

a scientifically compounded chemical sprayed on coated surfaces and tubes while boiler operates

FILL OUT AND MAIL

SAVERITE ENGINEERING COMPANY

1029 Clinton Street, Hoboken 3, N. J.

Send details of Saverite Soot Eliminator to

Name .....

Position .....

Company .....

Address .....

PLANS

For

PURE WATER

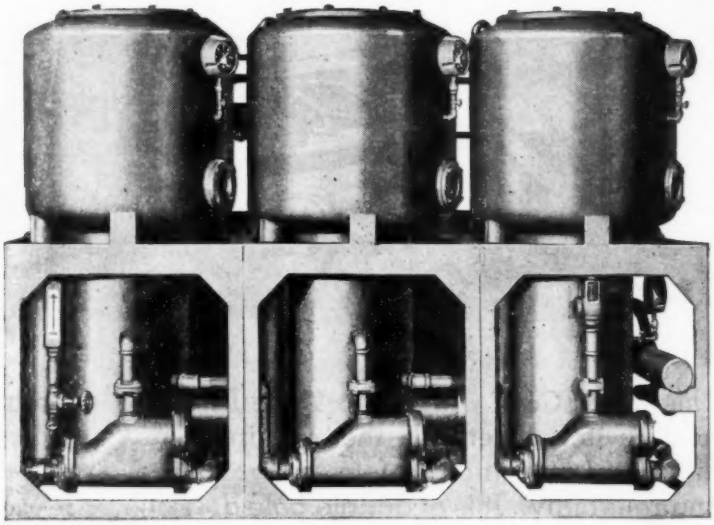
SHOULD SPECIFY

HENSZEY *Distillation* SYSTEMS

Extremely compact Henszey units can be built to any desired capacity from 3,000 to 50,000 pounds per hour—with or without integral boilers. They can be fabricated from steel, stainless steel, monel, copper or combinations of the above to meet your needs.

So if your problem is an abundance of low cost, fresh water of highest quality and purity — consider a Henszey Distillation System. Send for new bulletin No. D140 just off the press.

HENSZEY CO., Dept. D6, Watertown, Wisconsin

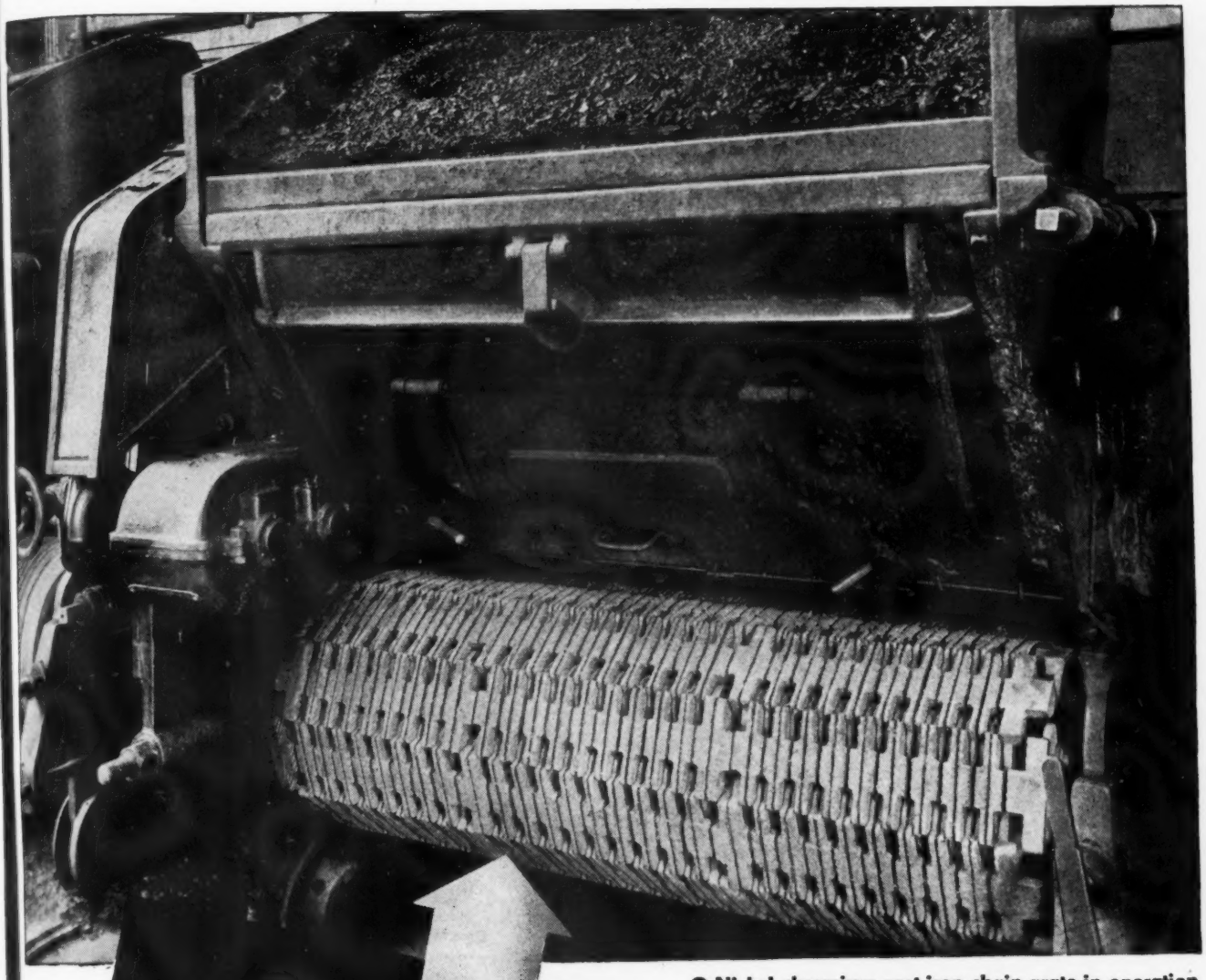


A 3 Effect SYSTEM with 6 Effect EFFICIENCY
A remarkable achievement of design and performance!

HENSZEY

DISTILLATION SYSTEMS

Continuous Blowdown • Heat Exchangers • Boiler Feed Regulators
Feed Water Meters • Flow Indicators • Proportioning Valves



● Nickel chromium cast iron chain grate in operation at the power house of a prominent Canadian brewery.

4 TIMES THE LIFE

OF PLAIN CAST IRON, WHEN MADE OF

Nickel chromium CAST IRON

FOR COMPLETE DETAILS WRITE TO:

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

ONE-MAN OPERATION

. . . saves time and labor *with* ROTO TUBE CLEANERS

No helper is needed with a Roto Tube Cleaner. One man can handle a tube cleaning job by himself with the convenient Roto Operating Air Valve on the motor.

Roto one-man operated tube cleaners will help to eliminate power losses and step up the capacity of your plant by descaling your tubes much faster than with old type cleaners.

Roto Tube Cleaners are available for all sizes and shapes of tubes, for operation with air, steam or water. Send for details.

Roto Model 135 air-driven motor with swing-frame head and air valve for one-man operation.

ROTO *Division of* **ELLIOTT COMPANY**

145 Sussex Ave. Newark 1, N. J.

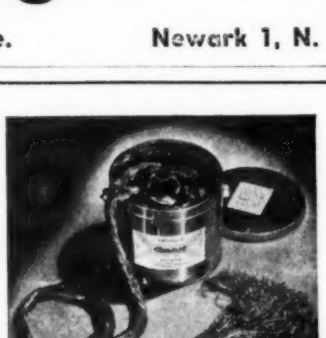
PATENTED "EUREKA" TRADE MARK

"AMBEST" METALLIC PACKING

the Universal Packing for ALL NEEDS

Whether for pumps, compressors, engines or valve stems —for water, steam brine, air, oil or gas—"AMBEST" solves the packing problem. It is the universally adaptable packing for every kind of service and recommended for use where rods are in good condition. Suitable for pressures and temperatures up to 550 deg.

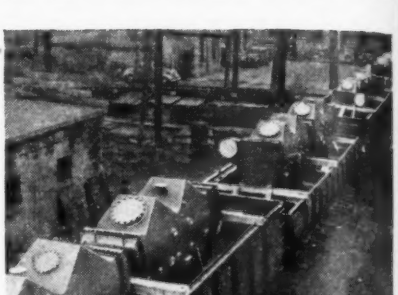
"AMBEST" is an anti-friction metallic packing. In shredded, long pliable strands, lubricated and graphited —made in one size for all applications—No Waste or Misfit. Stays pliable—will not scratch. Try it once and you'll use it always.



Send for trial sample. Write for the 36-Page complete Eureka Catalog.

EUREKA PACKING CO. 294-296-46th St., Brooklyn 20, N. Y.

STEAM CONDENSERS



A Shipment of Main Condensers Leaving Our Carbondale Plant

STEAM CONDENSERS

•

EVAPORATORS

Self Descaling (Patented) *Coil Type*

•

DISTILLERS **FUEL OIL HEATERS**

•

FEED WATER HEATERS

•

COOLERS

Fresh Water *Lubricating Oil*

•

STEAM JET AIR EJECTORS

•

VENT CONDENSERS

HEAT TRANSFER PRODUCTS, INC.

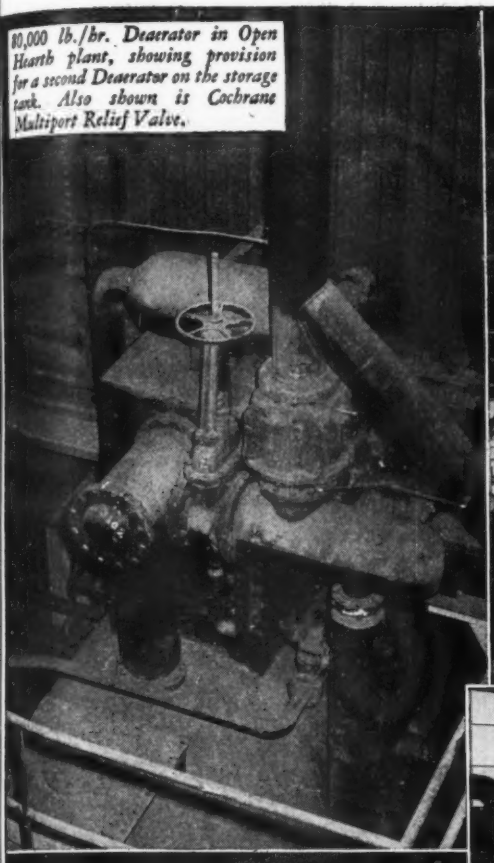
Engineers *Manufacturers*

90 West Street New York 6, N. Y.

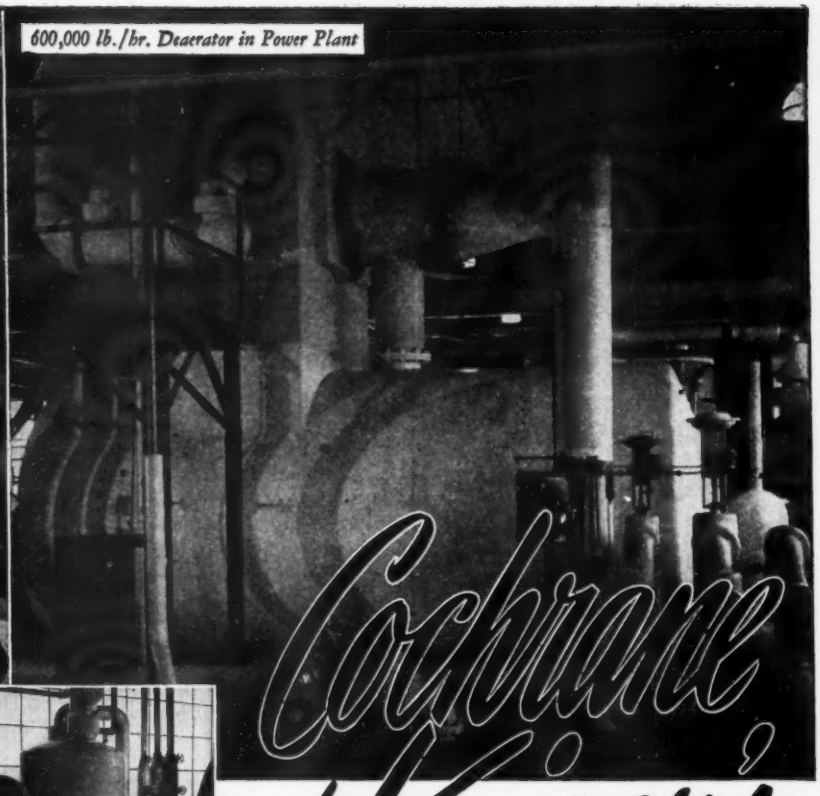
West Coast Representative
HARRY W. PARSONS, Inc.
24 California St., San Francisco 11, Cal.

HTP

PLANT: CARBONDALE, PA. (90,000 Sq. Ft.)



80,000 lb./hr. Deaerator in Open Hearth plant, showing provision for a second Deaerator on the storage tank. Also shown is Cochrane Multiport Relief Valve.



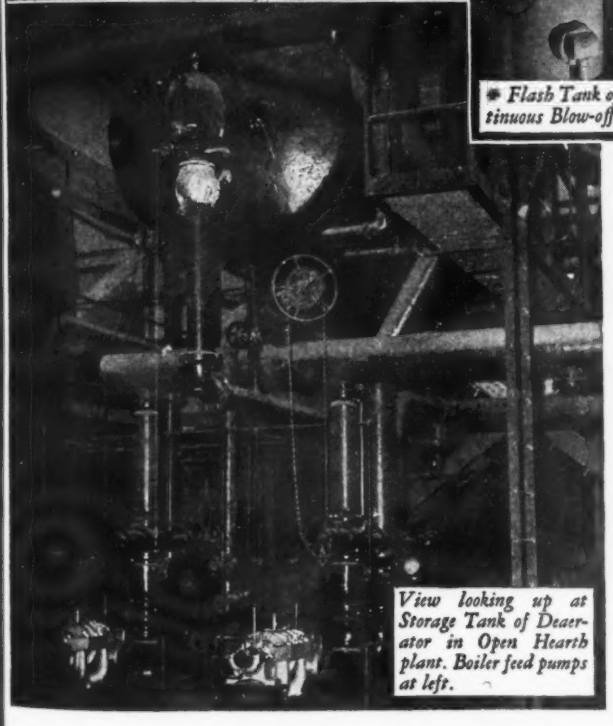
600,000 lb./hr. Deaerator in Power Plant

Cochrane at Kaiser's

STEEL MILLS

FONTANA • CALIFORNIA

* Flash Tank of Continuous Blow-off System.



View looking up at Storage Tank of Deaerator in Open Hearth plant. Boiler feed pumps at left.

The great modern steel plant designed and erected by the Kaiser Company, Inc. at Fontana, California has a power plant in keeping with its other ultra modern equipment.

Noteworthy is the Cochrane 600,000 lbs./hr. Deaerator mounted on a horizontal cylindrical storage tank, delivering oxygen-free feed water to the boilers, which generate the steam supply for Coke Ovens, Blast Furnace, Open Hearth and Rolling Mills. Another Cochrane Deaerator of 80,000 lbs./hr. capacity is located in the basement of the Open Hearth plant supplying oxygen-free make-up to the boiler, in which is used the waste heat from the Open Hearth furnaces. This deaerator is mounted on a horizontal cylindrical storage tank, which has provision for mounting a second deaerator of equal size. A Cochrane Continuous Blow-off System serving 3 boilers is also installed in the Power Plant.

COCHRANE CORPORATION • 3106 N. 17th ST. PHILADELPHIA 32, PA.

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

C. H. WHEELER OF PHILADELPHIA

STEAM CONDENSERS

•

AIR EJECTORS

•

MECHANICAL DRAFT COOLING TOWER

•

DECK MACHINERY

C. H. WHEELER MANUFACTURING Co.

19th St. & Lehigh Ave.

Philadelphia 32, Pa.

Make Your Overhead Valves SAFE And Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.

New Bedford, Mass.

FULLER ROTARY COMPRESSORS
BUILT FOR CAPACITIES TO 1800 C.F.M. PRESSURES TO 125 LB. VACUUMS TO 20.00 IN. REFERRED TO 30 IN. BAROMETER
AND VACUUM PUMPS
"SPOT" YOUR COMPRESSORS
FULLER
FULLER COMPANY

Why — long distance pipe lines and their attendant losses and upkeep?

Locate your compressors in the departments where air is required. Eliminate the cost of long distance pipe lines, consequent leaks, upkeep, and accompanying line friction losses.

With compressors "*spotted where you need the air*", they can be shut down when the various departments have completed their daily cycle of operations. This means a saving in power, supervision, and maintenance . . . in many cases has paid for the installation in a comparatively short time.

Bulletin C-5 illustrates and describes these machines. It's yours for the asking.

FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago 3 · 1144 Marquette Bldg.
San Francisco 4 · 421 Chancery Bldg.
Washington 5, D. C. · 618 Colorado Bldg.

No. 3 of a series

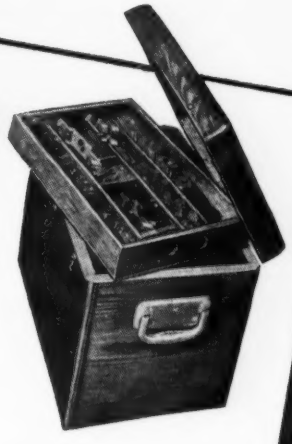
C-111

FULLER

PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

AS STEAMFITTER, I'M THE ONE WHO USES

DEXTER VALVE RESEATING MACHINES AND CUTTERS



We don't have extra helpers around the plant these days. Every man has more than enough work ahead of him. That's one big reason why we're so happy with our new Dexter Valve Reseating equipment.

One man can reseat a leaky valve right on the line, in just a few minutes, the Dexter Way. No more costly delays and long shutdowns while we gather a crew, break out the leaky valve and replace it — even if we could get a replacement.

We've found that the Dexter outfit is more than just a kit of tools — it's a scientifically engineered unit that saves us time and money every day.

RESEATS ANY GLOBE, GATE OR PUMP VALVE ON STEAM, AIR, WATER AND OIL LINES

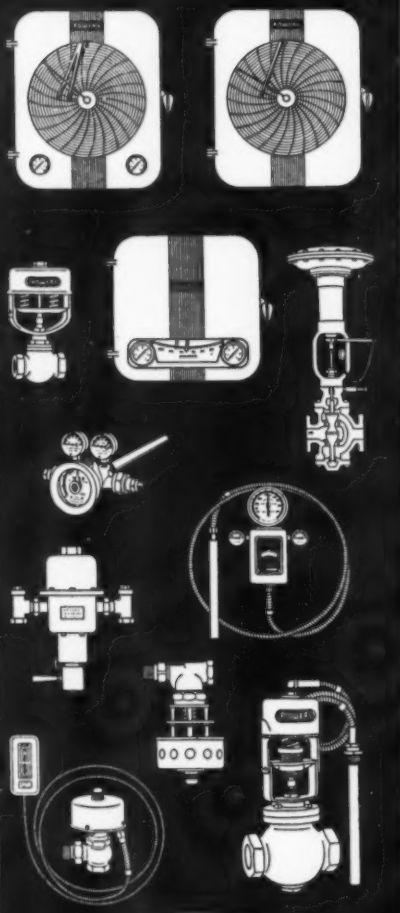
A large part of our production facilities is devoted to war work. Orders for Dexter Machines and Cutters, from firms who want this economy and efficiency, have far exceeded our nonmilitary manufacturing facilities. Please be patient — we will deliver just as quickly as possible.

Write us full particulars of your leaky-valve problems — make, size, type and material, use and pressure. We'll suggest our solution, without obligation.

24

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS

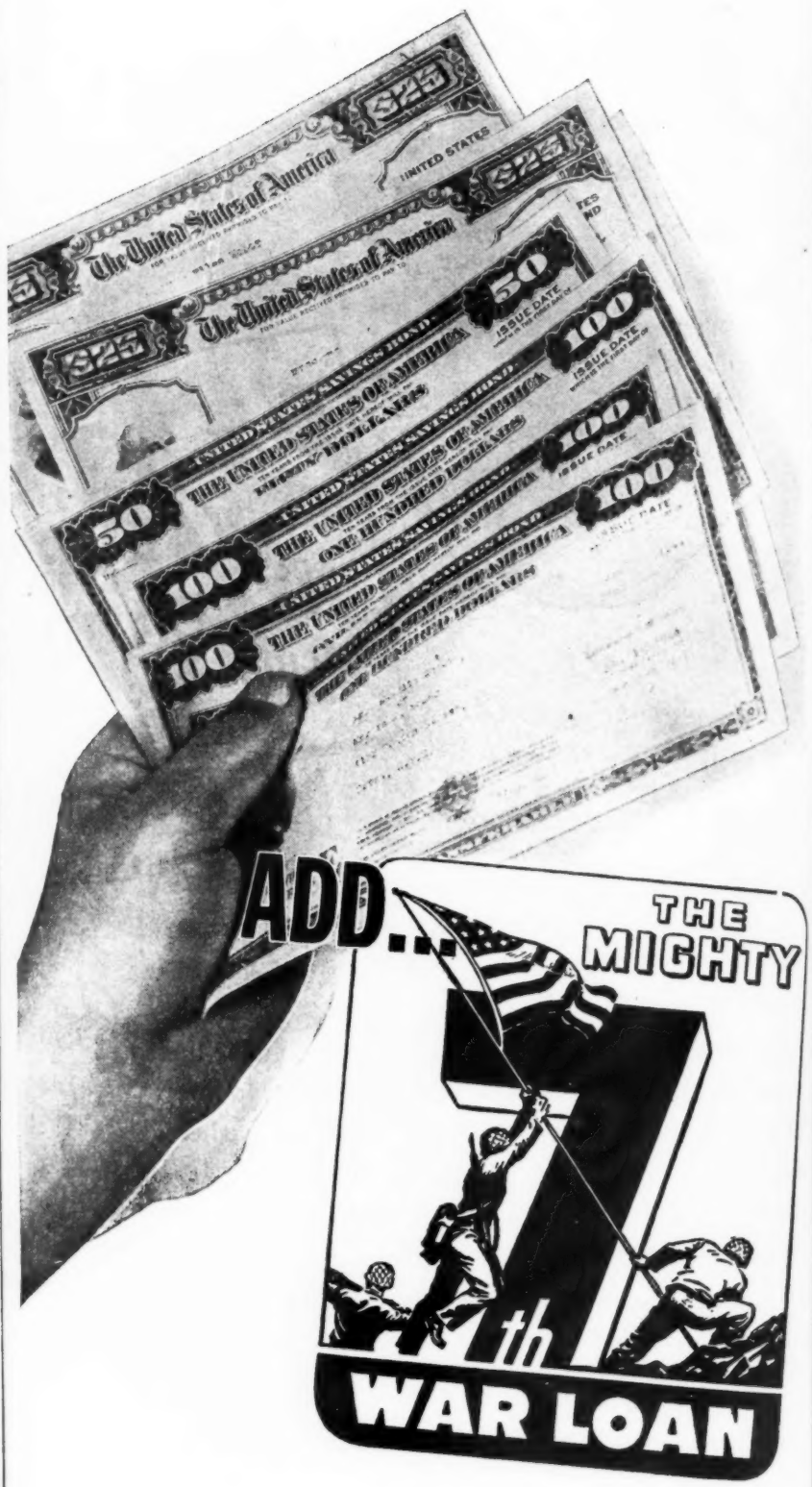
POWERS
TEMPERATURE and HUMIDITY
CONTROL



When you want accurate and dependable automatic temperature or humidity control for Industrial Processes, Heating or Air Conditioning Systems, call in a Powers engineer. With over 50 years of experience and a very complete line of self-operating and air operated controls we are well equipped to fill your requirements.

Write for Circular 2520
2771 Greenview Ave., Chicago
Offices in 47 Cities—See your phone directory.

THE
POWERS REGULATOR CO.



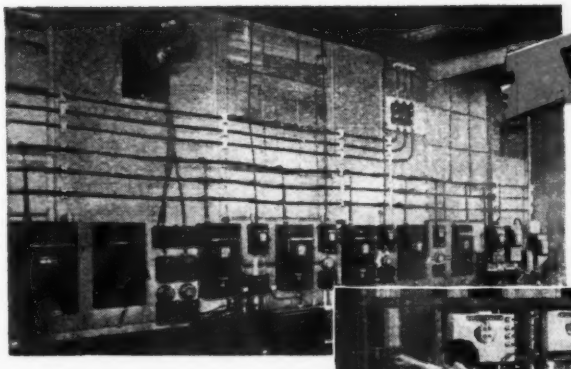
A War Bond Message Designed and Contributed by Buell Engineering Company, Inc., New York

buell
DUST RECOVERY SYSTEMS

WIRES *and* CABLES

Whatever your plant-wiring needs, rely on Graybar to meet them as fast as today's conditions permit. Graybar normally stocks a wide variety of types and sizes of wire and cable — bare, insulated, and armored — for ordinary and special services. Even today, some types are quickly available.

For wiring the products you build, too, count on Graybar for real help in choosing the right conductors. Among the many types Graybar distributes are fixture wires, magnet wires, aircraft cables, shielded cables for electronic circuits, flexible rubber and synthetic cords and sets made to individual specifications. *Graybar Electric Company, Graybar Building, New York 17, N. Y.* 4530

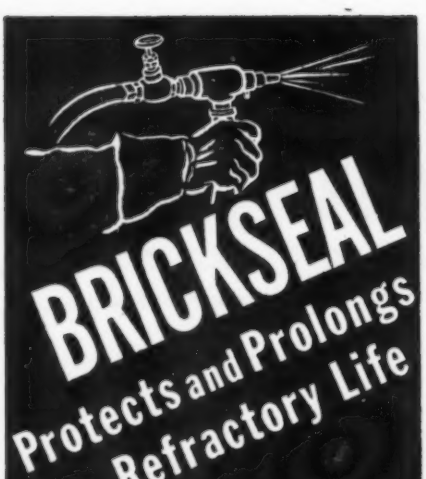


FOR YOUR PLANT

FOR YOUR PRODUCT

Via GraybaR
...the Double-Duty Source of Supply

IN OVER 80 PRINCIPAL CITIES



Applied like paint, prevents cracking and spalling

Now, more than ever, anything which prevents interruption of steam production is of vital importance. Brickseal refractory coating prolongs the life of new or old brickwork by preventing disintegration due to cracking, spalling and slagging.

Brickseal consists of high-fusion clays and metals combined in oil. Furnace heat drives off the oils and vitrifies the clays and metals, permanently binding the bricks with a highly-glazed, vitreous, monolithic coating, impervious to gases, carbon and air infiltration. The highly reflective surface keeps heat inside and increases boiler efficiency.

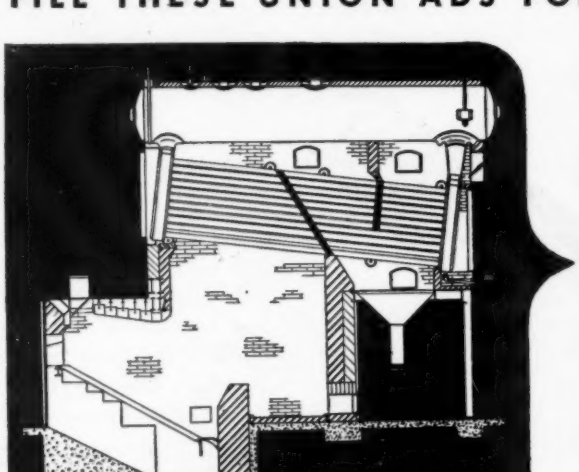
At operating temperature Brickseal becomes semi-plastic so that it expands and contracts with the wall, and therefore cannot crack, peel or blister due to sudden temperature variations. This feature also enables Brickseal to bind loose brickwork and old cracks. Slag and clinkers can be removed without damage to lining. Brickseal is applied easily with brush or spray gun, and the boiler may be fired at once. At very little cost, Brickseal will assure longer, uninterrupted production. Write for sample.

BRICKSEAL
REFRACTORY COATING

Factories at
1031 Clinton St., HOBOKEN, N. J.
5800 S. Hoover St., LOS ANGELES 44, CALIF.

UNION

FILE THESE UNION ADS FOR REFERENCE



H-TYPE
A-TYPE
LONG DRUM
RADIANT TYPE
4-DRUM
O-TYPE
L-TYPE
CROSS-DRUM
UNIVERSAL STEEL-CASED
UNIVERSAL BRICK-SETTING
HORIZONTAL RETURN TUBE
ATTLE GIANT
HEATING

UNION LONG DRUM BOILER

For a half century we have been adapting this popular boiler design to hundreds of industrial and institutional steam demands. Constant refinements in design, better materials and advanced manufacturing methods combine to make this old favorite a really outstanding performer today. It's a fast steamer and a steady one that fits into any moderate 24 hour steam demand. One look at our user list will show that it is serving "Who's Who" in the U. S. A. ***For complete data on this boiler write for booklet.***

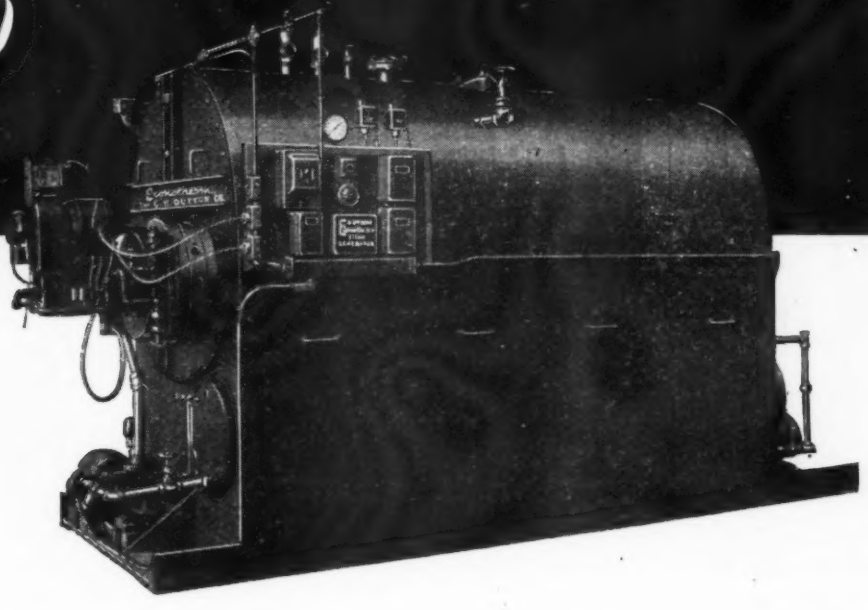
UNION IRON WORKS • ERIE, PA.

BOILERS

PRESSURE VESSELS • PLATE FABRICATION

Dutton ECONOTHERM
STEAM GENERATOR

Automatic! Compact! . . . and backed by 65 years experience

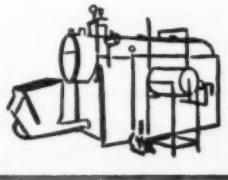


For over half a century Dutton has been a leader in engineering advancements of steam applications for processing, power and heating — this skill and "know how" is combined to make the Dutton Econotherm Steam Generator unsurpassed in performance and economy of operation and maintenance.

In one modern, streamlined, entirely self-contained unit the Dutton Econotherm will give you twice the power in half the usual space. So completely packed that your only installation costs are connecting fuel, water and steam lines — a saving of at least 20%. So ingeniously automatic that you are guaranteed perfectly balanced performance, positive water level and maintained steam pressure with a minimum of supervision.

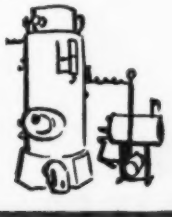
The exclusive Dutton designed Induced Draft System insures uniform temperature immediately on firing and meets steam withdrawal without variations in pressure or changes in water level. All gases are scavenged with maximum fuel utilization, using only a pipe to carry flue gases through the roof.

The Dutton Econotherm for either gas or oil firing, is designed to meet all requirements of capacities up to 150 H.P. — overall efficiency of 80% is guaranteed. Write for full information, stating your application and requirements.



DUTTON ECONOMIST
HIGH PRESSURE BOILERS

Dutton

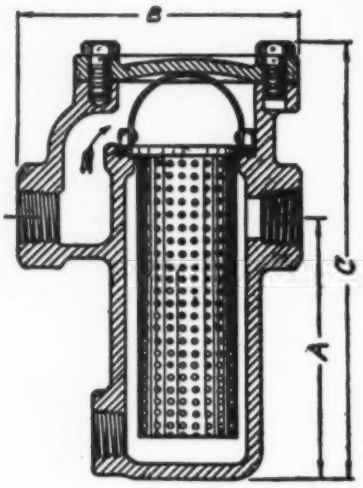


DUTTON AUTOMATIC
VERTICAL BOILERS

PRESSURE VESSELS • HEAT EXCHANGERS • CONDENSERS

THE C. H. DUTTON COMPANY • 622 GIBSON STREET • KALAMAZOO, MICHIGAN

EDCO STRAINERS



BASKET TYPE FOR VARIOUS FLUIDS

The EDCO basket type strainer is used extensively on suction and pressure pump lines carrying water, oil and other fluids.

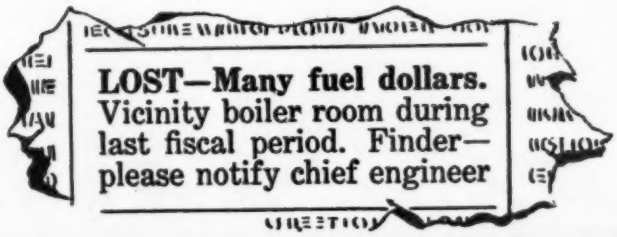
The baskets are made from either brass or steel screens or perforated sheets, depending on the nature of the operation.

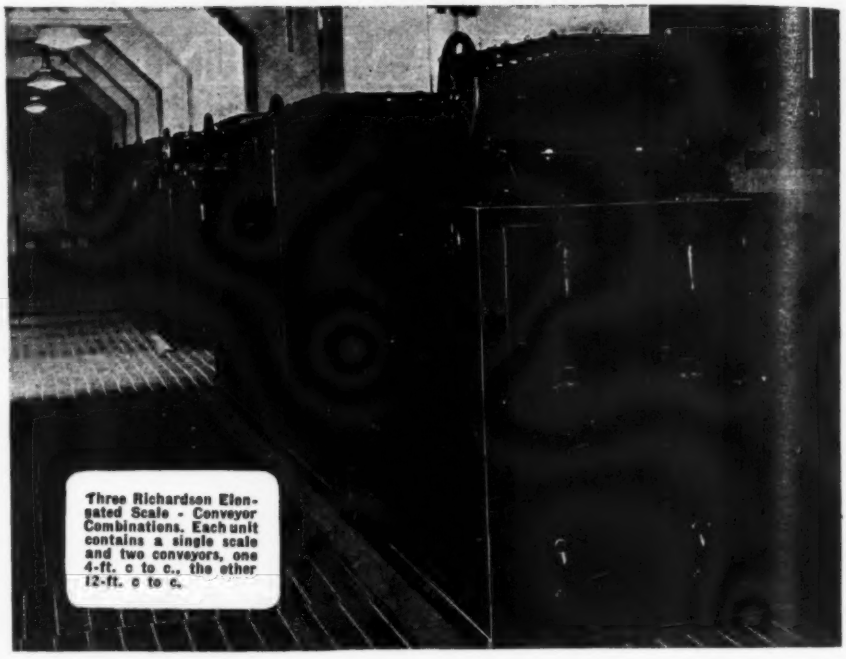
EDCO Strainers are easily removed for cleaning by the handle attached to the basket. The body and cap are cast bronze but can be made from steel or semi-steel, threaded or flanged.

EDCO makes strainers for steam — air — gas and fluids. Write today for detailed data on these products. They offer you many savings. Ask for Bulletin 863.

EDDINGTON METAL SPECIALTY CO.

P. O. BOX K EDDINGTON, PA.




Three Richardson Elongated Scale - Conveyor Combinations. Each unit contains a single scale and two conveyors, one 4-ft. c to c., the other 12-ft. c to c.

COAL LOSSES CANNOT BE RECOVERED —They Must Be PREVENTED

Dollars lost through inefficient coal consumption are lost forever! Guard against wasting YOUR fuel dollars by installing Richardson Automatic Coal Scales. The Richardson coal weighing and feeding system will spot the coal-wasting boilers before losses become serious.

A complete Richardson installation consists of: *Gate* from the bunker; flexible *Inlet* to scale; the *Automatic Coal Scale;* and *Monorate Distributor* to stoker, or down-take *Chute* to pulverizer. By distributing coal evenly across stoker hopper without *segregation* the Monorate Distributor greatly increases combustion efficiency.

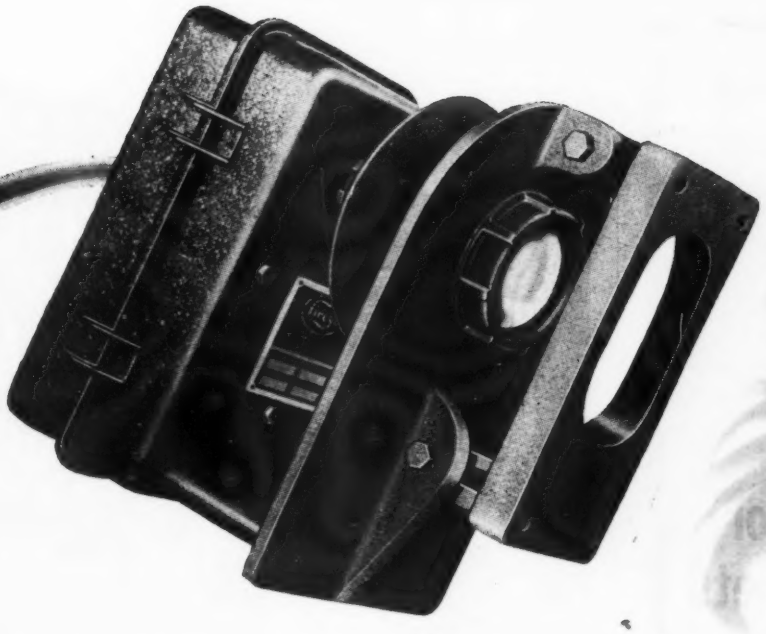
The Richardson line of Automatic Coal Scales includes: stationary floor-mounted models, stationary and portable models mounted at mid-section, and combination Conveyor and elongated Scale. The Elongated Model illustrated is of special interest where headroom is limited, where coal is fed from as many as five bunker outlets located as much as 35 ft. apart.

Full details on the complete Richardson system of coal control economy are available in Bulletin No. 1143, yours on request. Write for it today.

RICHARDSON SCALE CO.

CLIFTON, N. J.

Atlanta • Boston • Chicago • Omaha • Montreal • New York • Philadelphia
Minneapolis • Detroit • San Francisco • Toronto • Wichita • Pittsburgh



EXPLOSION PREVENTER

Postwar model . . . *but now!*

There's just one reason for putting a Flame Failure Safeguard on an oil or pulverized coal burner — to prevent an explosion. No control which does not react instantaneously to flame failure can provide full protection. It is the few seconds of delay lost between flame failure and fuel cut-off that charges the combustion chamber with potential destruction. Equipment that depends upon changes in temperature or in flame characteristics, such as electrical conductivity, must be ruled out in the dependable system. Only the surest control is worthy of the responsibility of protecting your property. Fireye is a *Photoelectric* Flame Safeguard. It is actuated by the direct light of the flame itself — but that is not all! Fireye is *photoelectric* in operation — does not depend on converting the light into heat in a mechanical gadget. Fireye sees the flame — acts instantly upon flame failure to cut off fuel and sound an alarm. Fireye mounts outside the boiler, looks through a window, is removed from destructive heat. Fireye is the flame safeguard of the future — proved and ready for you now.

Combustion Control Corporation • **Cambridge 42, Mass.**

District Offices in all Principal Cities

photoelectric fireye flame safeguard

Ask the Oakite Representative

about descaling

Air Compressor Water Jackets

Water jackets and jacket lines of air compressors should be checked and cleaned at frequent intervals for efficient operation and long life of the unit.

Heavy scale present acts as an insulator reducing cooling efficiency, and can be removed from jackets by circulating a solution of specialized Oakite Compound No. 32, a highly effective, controlled acidic material, which can be forced through the jackets by means of a small circulating pump or run through from a container placed above the cylinders.

FREE Digest Gives Details of 71 Different Maintenance Jobs!

Write TODAY for a FREE 20-page valuable Oakite Digest which is filled with facts of power plant engineers' experience using Oakite materials and methods to help insure longer equipment life.

OAKITE PRODUCTS, INC.
23 Thames St., NEW YORK 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized cleaning*
Buy Bonds for Victory
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

HERE'S WHAT BOILER ROOM "SUPERS" ARE SAYING:

"Treat it right... with SODIUM ALUMINATE ...and your boiler feed water will be soft and scale-free"

HOW THEY DO IT:

To insure trouble-free, economical operation of modern steam generating plants, experience has proved the effectiveness of adding Sodium Aluminate via one or the other of these methods:

1. EXTERNAL TREATMENT

In addition to lime and soda ash (hot or cold process softening), the admixture of 10 ppm.-50 ppm.* Sodium Aluminate, prior to introduction to the system, has proved extremely efficient. Advantages include the following: (1) Better clarification, (2) Increased removal of hardness, (3) Increased filter efficiency, (4) Increased magnesium removal without excessive causticity, (5) Silica removal, (6) Reduction of total solids.

2. INTERNAL TREATMENT

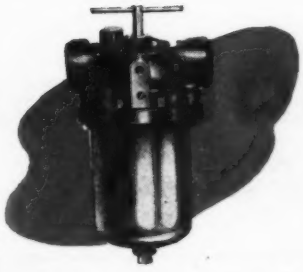
In units of moderate or low pressure, adequate results are obtainable by adding chemicals direct to the boiler. By combining Sodium Aluminate with soda ash, caustic soda or sodium phosphate within the system, (1) the soluble scale-forming silicates, salts of calcium and magnesium are changed to insoluble compounds, (2) the insoluble compounds are coagulated and kept in a flocculent mass for easy removal during the blow-down.

Monsanto's Sodium Aluminate, is a high strength product, 90% soluble sodium aluminate, extremely low in iron and insoluble material. It is extremely stable in water solution . . . a 10% solution is stable for several days and lower concentrations are increasingly more stable.

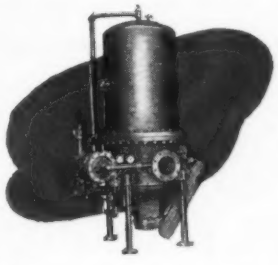
For complete information on Sodium Aluminate for Water Treatment, or for consultation with trained technical men on this problem, write, wire, or phone: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Massachusetts.

*Since natural waters for pretreatment vary widely in character laboratory jar tests are necessary to determine correct dosages.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND



AUTO-KLEAN *disc-type.* For all fluids except those containing highly abrasive solids. Viscosities from 30 to 50,000 Saybolt Seconds. Cleaner blades give positive mechanical cleaning of filter element (manually or motor-driven). Handles full flow, yet no larger than usual partial-flow type. Minimum pressure drop. Continuously cleanable. Sizes from 1¼" diam. x ⅞" cartridges to massive motor-driven models. With variety of built-in types.



FLO-KLEAN *wire-wound.* For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. May be designed to remove particles .0025" or larger. Motor-driven backwash nozzle gives positive hydraulic cleaning of filter element. Low pressure drop — fluid moves in straight line, encountering only momentary restriction. All parts made of metal — constructions to meet varying corrosive and erosive conditions.

AIR-LINE *for compressed air.* Removes solids, entrained moisture and oil from compressed air. It is an edge-type filter of metal disc construction. Brass element has .0015" spacing. No cleaner blades. Removal of trapped dirt, water and oil is accomplished by opening petcock at bottom.

★ ★ ★

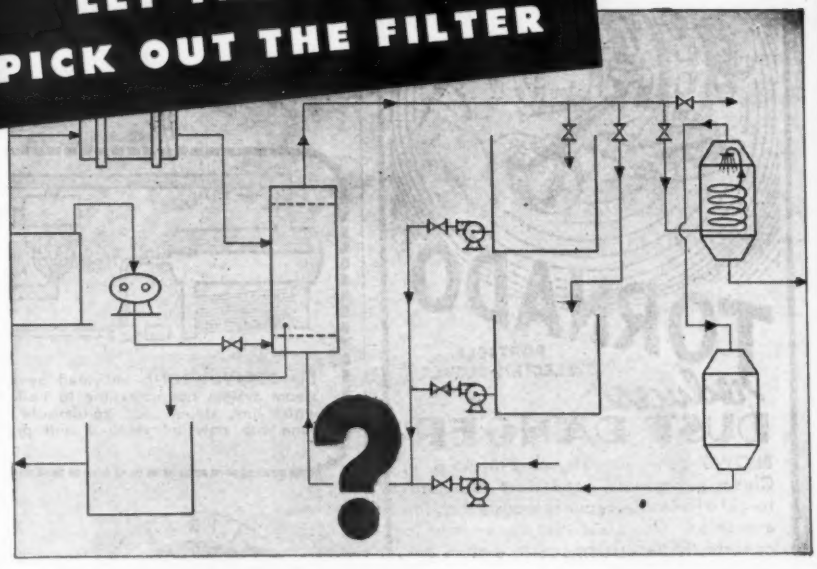
Catalog of filter selection factors and specifications will be found in SWEET'S. Or inquire for specific information on your type of application by sending us the coupon — no obligation.

KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

LET THE FLUID PICK OUT THE FILTER



In the Cuno line you'll find the right type for the fluid . . . the flow . . . the physical conditions

Start with the nature of the fluid — acid, alkaline or neutral, corrosive, inert, stable, unstable, etc. — and the nature of the solids it carries, the minimum size to be removed. Consider the flow — gravity, suction or pressure, maximum velocity, allowable pressure drop. And the temperature at filtering point, viscosity, operating conditions.

Then decide how clean the fluid should be — how clean it is to start with, and how clean it should be kept. When these matters have been settled, the choice of a fluid-cleaning method is easy — because, in the Cuno line, you will find the filter that will keep flow on "Go".

Three of the several *types* of filter Cuno offers are shown here. Adaptations of these are often made, under the direction of Cuno's engineering staff, to meet special service conditions. Have us send you a copy of the Cuno Catalog. There is a coupon below for your convenience.

CUNO ENGINEERING CORPORATION
226 South Vine Street, Meriden, Conn.

Please send me a free copy of your new catalog. I am especially interested in the services checked.

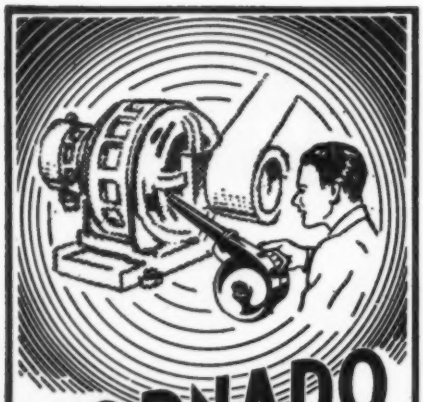
- ☐ Acids
- ☐ Air
- ☐ Alkali
- ☐ Boiler Feed
- ☐ Casein
- ☐ Cleaning Solutions
- ☐ Coatings
- ☐ Compressed Air
- ☐ Coolants
- ☐ Cutting Oils
- ☐ Dip Tank Systems
- ☐ Enamel
- ☐ Engine Fuel
- ☐ Engine Lubricating Oil
- ☐ Fuel Oil
- ☐ Fuel Tar
- ☐ Gases
- ☐ Gasoline
- ☐ Grease
- ☐ Grinder Coolant
- ☐ Hydraulic Oil
- ☐ Japan
- ☐ Lacquer
- ☐ Lubricating Oil
- ☐ Machine Tool Cutting Oil
- ☐ Machine Tool Hydraulic Oil
- ☐ Machine Tool Lubricating Oil
- ☐ Nitrocellulose Solutions
- ☐ Oils
- ☐ Paint
- ☐ Pyroxylin
- ☐ Quenching Oil
- ☐ Resins
- ☐ Rust Proofing Compounds
- ☐ Sizing
- ☐ Solvents
- ☐ Spray Systems
- ☐ Tar
- ☐ Test Stand Lubricating Oil
- ☐ Varnish
- ☐ Washing Compounds
- ☐ Water
- ☐ Wax

Others .....

Name.....

Company.....

Address.....



TORNADO

PORTABLE ELECTRIC BLOWER

reduces

DUST DANGER

BLOWS clean, dry air, at 295 m. p. h. Cleans out motors, generators and hard-to-get-at places—removing dust, dirt, lint and chips. Costs less than 3c. an hour to operate. Reduces damage to motors and bearings—lessens fire and health hazards.

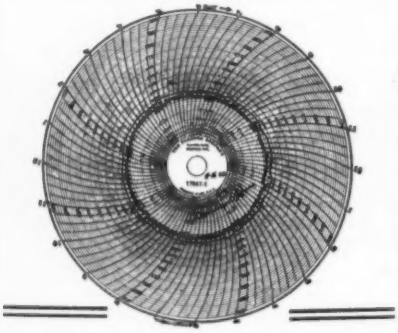
1 H. P. universal G. E. motor. Weight, 14 lbs. Portable to any place in plant. Plugs in at convenient outlets. Adaptable as Sprayer for spraying paint and insecticide. Convertible into powerful industrial Vacuum Cleaner—for cleaning floors, walls, ceilings.

Free Trial—Write to

BREUER ELECTRIC MFG. CO
5114 N. Ravenswood Ave., Chicago 40

TAKE THE DUST OUT OF DUSTY JOBS

TORNADO



A Chart like this in your boiler room means money in your pocket

Let the Exclusive

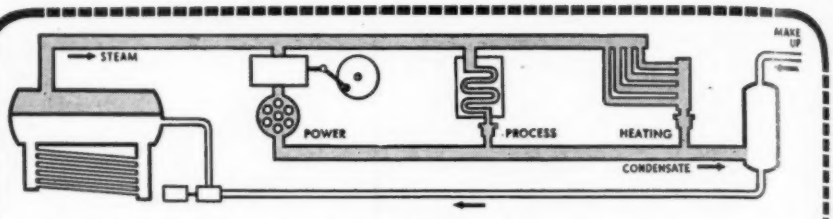
Sterling System

bring back condensate under pressure — and save fuel . . .

Here's the modern way to reduce power costs. The Sterling System will quickly pay for itself in any plant which is now venting to the atmosphere. Brings back high pressure condensate to the boilers under pressure, with practically no heat loss and only a nominal drop in temperature.

STERLING ENG. & MFG. CORP.
(Templeton Mfg. Co.)
110 Business St.
Hyde Park 36, Massachusetts

Here's How to PREVENT CORROSION *in Your Steam System . . .*



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

LINES CORAVOL BOILER

SAVES YOU COSTLY PIPE REPAIRS, REPLACEMENTS, MAINTENANCE LABOR, HOURS AND DAYS OF SHUTDOWN LOSS

CORAVOL in your steam system (1) prevents corrosion in steam and condensate lines, (2) cleans out clogging rust deposits resulting from previous corrosion.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE WHICH PROVIDES SPECIAL FORMULAS OF TREATMENT FOR:

Boiler Feed Water . . . Hot Water Supply . . . Refrigerating Brine . . . Cooling and Condenser Water . . . Rapid Scale Removal . . . Coagulation . . . Algae Control.

NOT A BOILER FEED WATER TREATMENT

When fed to your steam system, **CORAVOL** *volatilizes* with the steam, *condenses* with the steam, and dissolves in the condensate. It does not remain in any one zone, but circulates throughout the entire system and protects *all* zones from corrosive attack.

CORAVOL SAVES FUEL. In cleaning out and protecting lines **CORAVOL** increases and maintains the effectiveness of heat transfer surfaces; restores and maintains original capacity of lines and the operating efficiency of valves and traps. For 8 years, **CORAVOL** has proved its value in hundreds of steam heating, process and power plants in more than 20 different industries. Mail the coupon *today* for complete FREE data about the **CORAVOL** process.

MAIL TODAY

WESTERN CHEMICAL COMPANY
715 Washington Street — Kansas City 6, Missouri

Without obligation to me, please send complete data on the CORAVOL Process

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY AND STATE _____ (2)

It's a High-Powered Induction Heating Source-

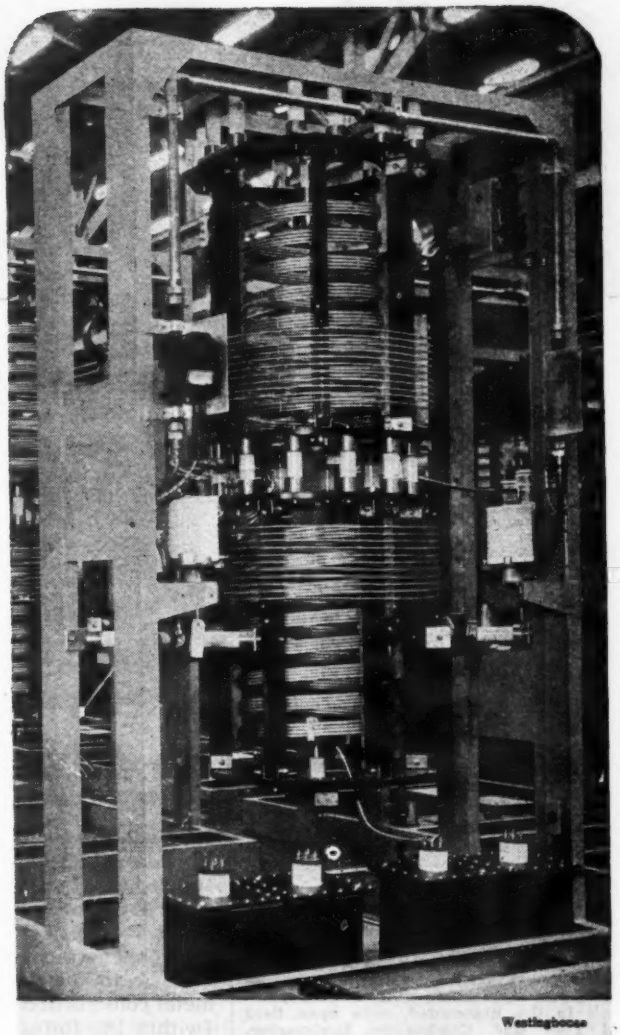
YOU'LL WANT THE PRODUCTION ADVANTAGES OF EQUIPMENT LIKE THIS—

BUT—IS YOUR ELECTRICAL WIRING PLANNED TO CARRY THE LOAD?

New, efficient equipment of every kind promises tremendous postwar production advantages. Don't let lack of electrical capacity bar you from such opportunities.

Make sure your wiring plans are based on *future* needs, not *past* experience. Remember, rush teardowns for alterations will be costly. Wire ahead!

Now is the time—while you're in the planning stage—to call in your consulting or plant power engineer, electrical contractor or power salesman. They'll agree *foresighted* wiring will cost a lot less than the "wait and see" kind. 45288



Westinghouse

In this working component of a high-powered induction-heating unit, brief applications of relatively large amounts of power heat metals from within. Heat distribution is quick, uniform.

ANACONDA

ANACONDA WIRE & CABLE COMPANY

GENERAL OFFICES: 25 Broadway, New York City 4 — *Subsidiary of Anaconda Copper Mining Company*

CHICAGO OFFICE: 20 North Wacker Drive 6 • Sales Offices in Principal Cities

Check Your Wiring Plans Before They Check You!

Combustion efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

Just a Few of Our Hundreds of Friends

International Harvester Co...28
Armour and Co..75
Combustion Engineering Company 45
Riley Stoker Corp. 75
Iron Fireman Mfg. Co. 38
Commonwealth Edison Company 145
State of Illinois..85
Cities Service (Oil & Power) 70
and many others.

How? Through the simple, easy reading, *practical* Hays Home Study course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

SEND FOR FREE BOOK

The coupon below will bring you, without expense, full particulars regarding the Hays short, practical, easy reading, home study Course in Combustion. Do your part by starting now to train yourself in the uncrowded wide open field of Fuel and Combustion Engineering. Hays trained men are in demand, today more than ever. Send the coupon Now. No obligation of course.

Hays Institute of Combustion
430 N. MICHIGAN AVE., CHICAGO, ILL.
DEPT. 10A
Our 26th Continuous Year

Hays Institute of Combustion,
430 N. Michigan Ave., Chicago—Dept. 10A

Please send me your Free Book "Opportunities for the Combustion Expert"—No Obligation.

Name .....

Address .....

City ..... State .....

Company Name .....

RELIABLE...readable

EVEN IN THESE *Rough Places*

WESTON THERMOMETERS are ALL-METAL for ALL-ROUND ruggedness

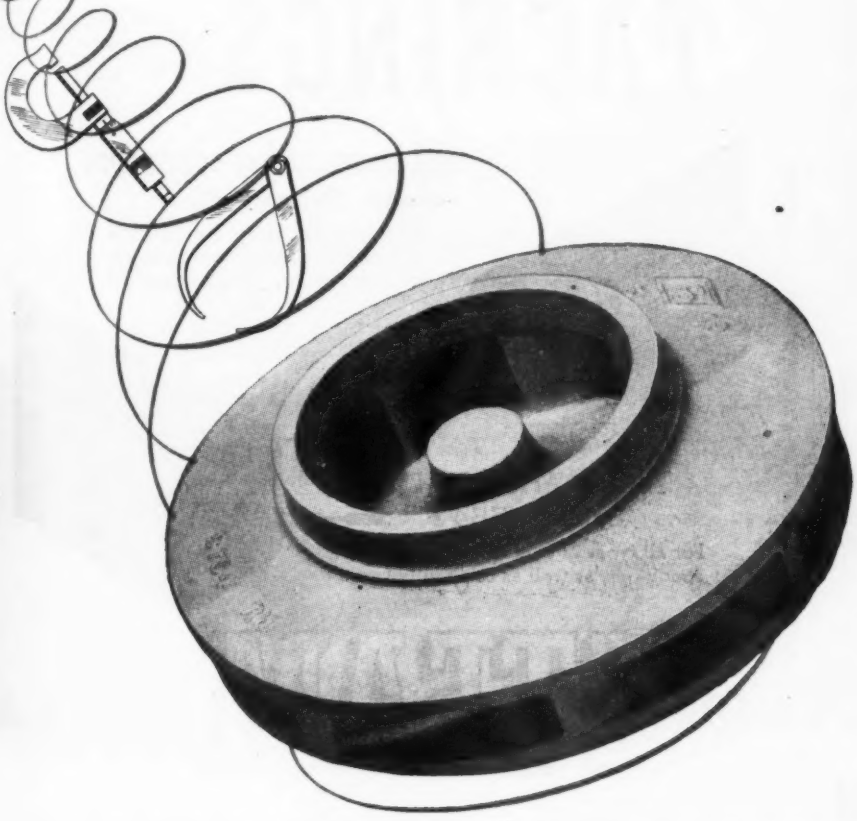
In tough spots like these, and many others too, *Weston All-Metal Industrial Thermometers* withstand shaking up without breaking down. Even the severe vibrations of pumping units or Diesel engines do not affect the long-term stability of Weston Thermometers.

Basic to their *all-round ruggedness* is an all-metal construction that insures sustained accuracy (within 1% full-scale) over long periods of time. There are no liquids, gases, capillaries or other troublesome parts. Simply an all-metal temperature element safely sheathed in a rugged stainless steel stem.

Weston All-Metal Thermometers are available in scale lengths 6", 9", 12" . . . stem lengths from 2½" to 48" . . ranges from – 100°F to + 1000°F. Literature gladly sent on request . . . Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

Weston *All Metal* **THERMOMETE**

Proper FINISHING...



means A QUICKER BEGINNING!

Sivyer goes beyond the point of usual foundry practice in finishing castings for *greater* dimensional accuracy . . . correct size, shape and contour. Thus, Sivyer castings get on the job faster.

This means less handling . . . less processing of castings on your end. And once they are on the job, by the same token of taking time to make a sounder product, Sivyer castings stay there *longer.*

Dimensional accuracy is just another reason why critical buyers specify castings bearing the Sivyer diamond ◈ —the mark worth looking for. The next job—simple or difficult—give Sivyer a trial.

SIVYER STEEL CASTING COMPANY
MILWAUKEE (S) CHICAGO (S)

ARMY (E) NAVY

ADAMANT
FIRE BRICK CEMENT

FURNACE LININGS
last longer . . .
with ADAMANT

Lay up linings with ADAMANT — its higher bonding strength (see below) protects the structure at the joints . . . where failure usually begins. Keep furnace maintenance costs down—keep production up . . . save on repairs and replacements—use ADAMANT.

ADAMANT
Stronger by Test

Impartial laboratory tests showed Adamant has a bonding strength of 800 lbs at room temperature 1270 lbs. at 2600° F Adamant has a P.C.E of 3000° F. plus. For more details, write

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

HERCULES
Seamless Copper
FLOATS

GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

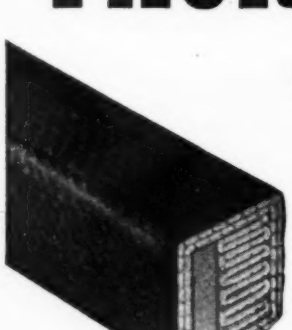
Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

BELMONT
PACKINGS



FOR RECIPROCATING STEAM RODS
← Belmont 30
For reciprocating steam rods where boiler temperature is in excess of 100 lbs. (340 degrees F.)

FOR ROTATING SHAFTS
Belmont 754 P →
For all types of centrifugal and rotary conditions, as well as oscillating rods.

FOR STEAM

Today, the war demands uninterrupted service of power plant equipment. Engines and pumps must be kept operating at maximum capacity—there is no time for frequent packing replacements.

Leaking valves . . . pistons . . . rods and plungers cause power losses which cut serious inroads into production.

Check now the packing in your stuffing boxes—at points of service—at prime movers—put the right packing on each job to avoid unnecessary delays through equipment failures.

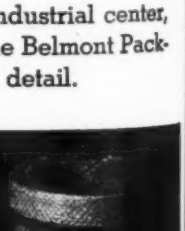
Above we illustrate two standard Belmont Packings for steam services. Belmont High Pressure Packing No. 30 is indicated wherever a packing is needed for high pressure steam rods, expansion joints, air and gas services.

For centrifugal and rotary shafts working against steam, water, oil and weak acids Belmont 754 P can be considered a standard packing.

Belmont distributors are located in every large industrial center, or write on your company letterhead for a copy of the Belmont Packings Catalog and see the complete Belmont Line in detail.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia. Forms include: Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.



THE BELMONT PACKING & RUBBER COMPANY
BUTLER & SEPVIVA STREETS • PHILADELPHIA 37, PA.

Eliminate DAMAGING WATER and OIL from Your Compressed Air Lines

WITH

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

Air Cooled to Within 10 DEGREES of Cooling Water! EASILY INSTALLED! Pipeline Construction

ADAMS equipment insures a constant supply of cool, moisture-free, oil-free air to power your compressed air tools with the highest efficiency and safety . . . at the *lowest* installation and maintenance cost.

ADAMS AFTERCOOLERS are *guaranteed* to cool air to *within 10 degrees* of your cooling water. This means *extra* thoroughness in condensing water and oil vapors from your compressed air.

NO FOUNDATION or other facilities are required for installation. The Adams "pipeline" construction permits the After-cooler and Cyclone Separator to fit right into a section of the pipe line . . . either vertically or horizontally!

CYCLONIC SEPARATION is the Adams principle . . . engineers agree that it is *far more efficient* than other mechanical separation!

WRITE!

today for full engineering data on improved pneumatic power performance. Ask for Bulletin 703.

R. P. ADAMS CO., INC.

67 Chicago St., Buffalo, N. Y.

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

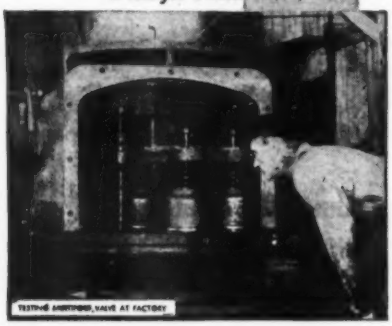
Why they Last and last and Last

The Cochrane Multiport Relief Valve is popular not only because of its remarkable service, but because of its long, trouble free life.

COCHRANE MULTIPORT RELIEF VALVES

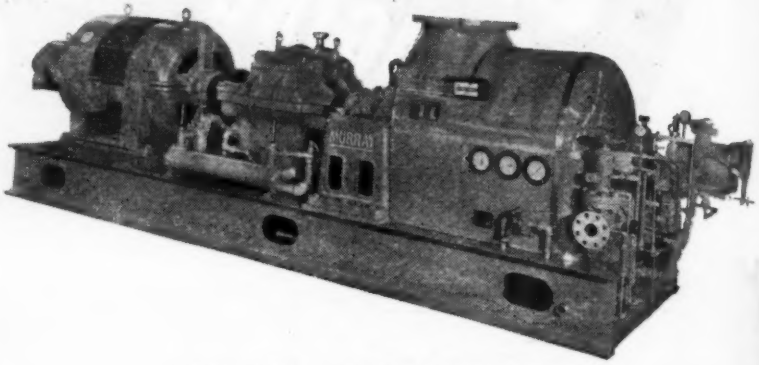
In many plants all over this country Cochrane Multiport Back Pressure Relief Valves have been operating continuously for ten, twenty, twenty-five years—and longer—without replacement of a single part. The care, the skill, the close precision to which this remarkable valve is built, are some of the reasons.

Write for Publication 4150



COCHRANE CORPORATION
A DIVISION OF AMERICAN ENGINEERING COMPANY
3106 N. 17th St., Philadelphia 32, Pa.

MURRAY
TURBINE-GENERATORS



500 KW — PACKAGE TYPE

The unit shown was designed to deliver 500 KW alternating current on steam at 285# Gauge initial pressure, 700 degrees F. total temperature and 27 inches vacuum. Provided with a rigid structural steel baseplate, and with all service connections except generator leads above the floor line, the machine can be handled as a unit and installed with a minimum of preparation.

While "Package Type" units were furnished for export for installation in remote areas not previously supplied with power, the design can be utilized for small industrial plants for main or standby power supply.

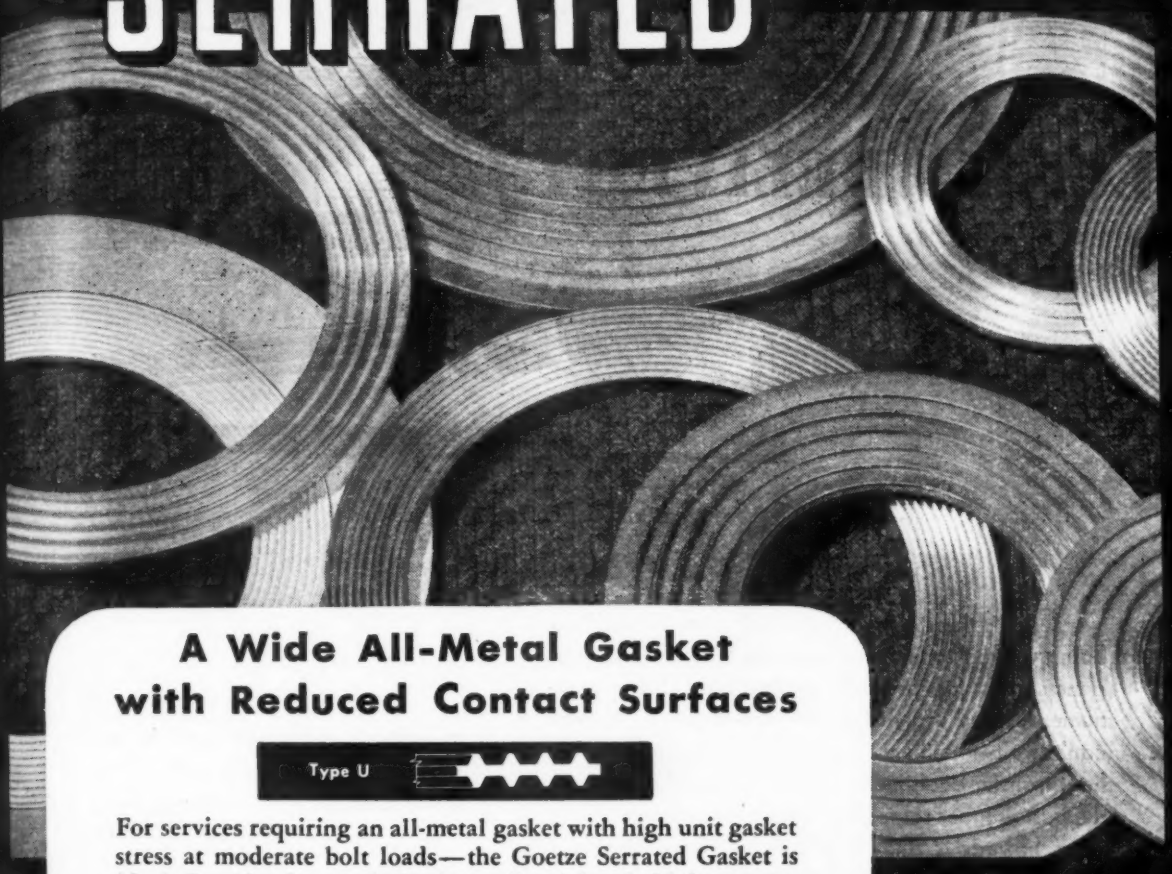
MURRAY also produces

Mechanical Drive Turbines
Reduction Gears
Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

MODERN DEVELOPMENTS OF GASKET RESEARCH

SERRATED . . .



A Wide All-Metal Gasket with Reduced Contact Surfaces

Type U

For services requiring an all-metal gasket with high unit gasket stress at moderate bolt loads—the Goetze Serrated Gasket is ideal. Growing in popularity for sealing joints in high pressure steam, process equipment and piping, this gasket is supplied in a wide range of materials and with serrations of a pitch designed to meet individual requirements of specific operating conditions.

An excellent example of advanced Gasket Engineering, this type is literally custom-built to meet the specifications of each use. The Serrated Gasket is another illustration of Goetze mechanical and metallurgical research that is producing the many modern developments in Gasket Engineering about which you will want to know.

Ask to have your name added to the list of engineers receiving "The Gasket"—a series of technical bulletins containing original gasket data emanating from the Goetze Research Laboratory. Write on your company letterhead giving your position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

LOWELL THOMAS Speaks on New Gasket Film

Now available to employee groups, technical societies, engineering schools and other organizations throughout the country, this new 35-minute Kodachrome film, "Only a Gasket," tells why these are the "Biggest little things" in modern Industry. Write for full information.

Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

SPECIAL TUBE DELIVERY

...TO MEET WARTIME EMERGENCIES

With steam power equipment everywhere being worked to limits of capacity these days, emergency calls for pressure tubing have been more numerous and urgent than in normal times. The war can't wait—neither can war-essential boilers and heat transfer equipment on land, sea and rails. Even the best of tubes sometimes have to be replaced more often nowadays due to prolonged, round-the-clock operation under extreme conditions.

As a leading tube manufacturer, B&W is called upon to supply many of these emergency replacements on short notice. A few examples cited here typify the urgency of such calls and how B&W was able to speed deliveries.

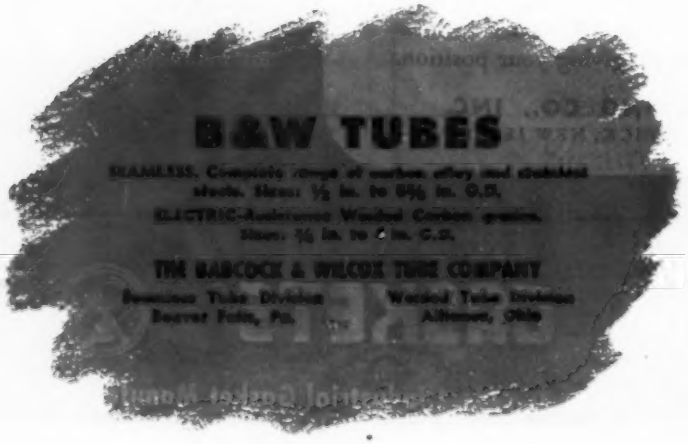
The reasons that enable B&W to meet these war-urgent emergencies are good reasons why you should specify B&W tubing for present and post-war needs for both welded and seamless pressure tubing. Consult B&W today.

Example 1—A troopship ready for convoy needed 13 tons of seamless boiler tubes . . . 926 pieces of complicated design were rolled, bent and delivered by B&W in 4 days.

Example 2—Facing a shut-down, a municipal power plant phoned for 12—4" x .203" x 18' boiler tubes . . . two hours later, tubes were en route by railway express.

Example 3—A west coast shipyard phoned for six stud tubes for B&W header-type boiler . . . within 24 hours tubes were on a night plane and installed the following day.

Example 4—A phenol plant faced a bottleneck for lack of 5,220 lb. of stainless steel tubes . . . the required 16' and 18' lengths of B&W tubes were flown 600 miles by the Air Transport Command.



Designed for Today's—

but Adaptable to Tomorrow's Dust Ordinances

The THERMIX DUPLEX

Collects Dust Both MECHANICALLY and ELECTROSTATICALLY

...or just mechanically if no more is required

Solve your dust collection problem once and for all with a Thermix Duplex! Insure efficiency for today's needs—be prepared to meet even more stringent anti-dust ordinances tomorrow!

The Thermix Duplex combines *both* mechanical and electrostatic dust collection in one unit. The ultra-fine dust, thrown by high centrifugal force to the sides of the central outlet tube of the main mechanical collector, is withdrawn through the annular opening and precipitated in a small electrostatic unit.

The mechanical section can be operated alone at times when this will suffice. If desired, only the mechanical section need be installed at the outset. Should dust collection problems become more severe, the electrostatic section can be added.

For real, all-time dust collection efficiency well over 90% total dust elimination as proved by actual tests, investigate the Thermix Duplex Dust Collector.

THERMIX ENGINEERING COMPANY

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

FLEXO JOINTS —are dependable

It makes no difference how hard the service may be—with high or low pressure steam, air, oil, water—you can always depend on FLEXO JOINTS. Everywhere in industry FLEXO JOINTS have proven their ability to give unsurpassed service. They are a productive investment; their economy has been clearly proven by leading manufacturers and shows that the first cost of FLEXO JOINTS is quickly repaid by savings and increased efficiency.

Install them in pipe lines that are moved or swung in different directions or on machinery or equipment that must be supplied with any fluid while in motion.

Write for details.

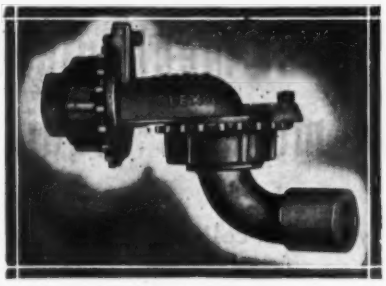
FLEXO SUPPLY COMPANY, Inc.

4224 Oliver Str. St. Louis (8) Mo.

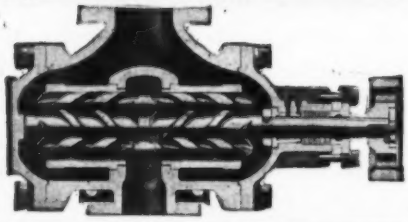
In Canada

S. A. ARMSTRONG Ltd.

115 Dupont Str. Toronto (5) Ont.



IMO



THE PUMP *without* PULSATION

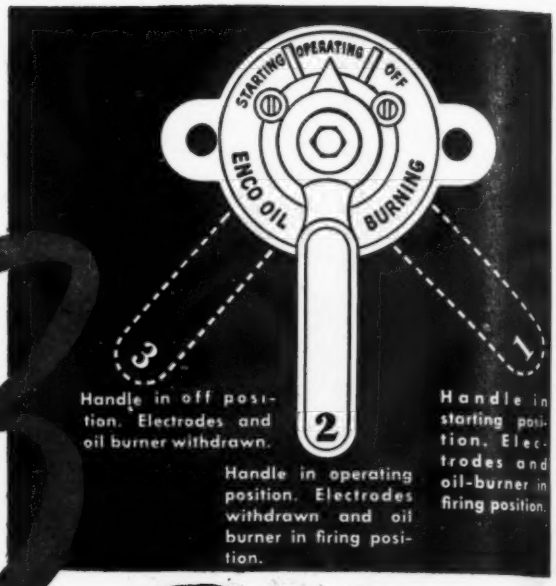
The steady, uniform flow produced by the continuous turning of the rotors in an IMO pump is ideal for oil burners, hydraulic and other service requiring an even, pulsation-free flow.

IMO

PUMP DIVISION OF THE DE LAVAL STEAM TURBINE CO.

TRENTON 2, NEW JERSEY

Hand Control Valve for cylinders . . . wall mounting . . . oil burner ignition system.



3 Step IGNITION SYSTEM FOR PULVERIZED COAL, OIL, OR GAS

FAST SAFE POSITIVE

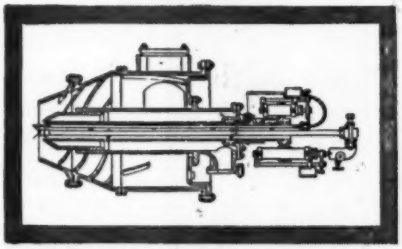
With an Enco Ignition System, operator can light off any burner by movement of a Hand Control Valve, located close to the pulverized-coal mill and fan controls, and within view of the instrument board. Automatically, a powerful ignition spark is established, and the light fuel turned on. Both are interlocked electrically — **the oil valve cannot be opened until the spark current is on and the atomizer is in firing position.** After the oil flame is established, a second movement of the control valve retracts the electrodes, leaving the atomizer in operation.

After ignition of the pulverized coal is established, a third movement of the control valve shuts off the oil and retracts the atomizer out of the hot zone, leaving the unit ready to repeat the operation as may be needed.

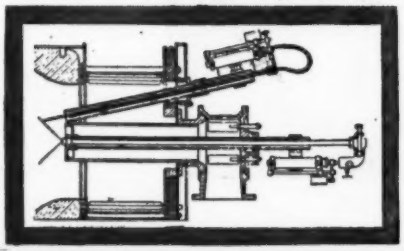
The Enco Ignition System has a wide range of application. Pulverized coal, blast furnace gas or any liquid fuel may be ignited by the unit, or the spark alone may be used to ignite natural or refinery gas. The ignition flame can be changed gradually from light to heavy fuel oil if continued operation under heavy load is required. The ignition flame also can be used as a substitute for principal fuel in emergencies.

Bulletin on request.

Atomizer and electrodes in the central tube.



Atomizer and electrodes in separate tubes.

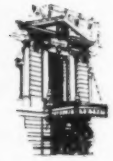


THE ENGINEER COMPANY
75 West Street, New York 6, N. Y.

Canada: F. J. RASKIN, Inc.
370 Rachel E., Montreal, P. Q.

Enco OIL BURNING EQUIPMENT

The Claypool is equipped with SLOAN FLUSH VALVES



The CLAYPOOL Hotel

EXECUTIVE OFFICES

INDIANAPOLIS

"The Doorway to Hoosier Hospitality"

December 20th, 1944

Affiliated NATIONAL HOTELS,

Mr. J. Edwin Aspinall,
Sloan Valve Company,
314 East New York St.,
Indianapolis, Indiana.

Dear Mr. Aspinall:

I thought you would be interested in knowing that 31 years ago the Claypool Hotel was equipped throughout with Sloan Valves. They have given entire satisfaction and to-day are in just as good condition as they were when installed. I cannot recommend too highly the performance of these valves.

With seasons greetings and every good wish, I am

Cordially yours,

THADDEUS E. SNODGRASS
GENERAL MANAGER
CLAYPOOL HOTEL

TES:AB

"THE DOORWAY TO HOOSIER HOSPITALITY" is a slogan difficult for any hotel to live up to in these strenuous days of war. But the Claypool is carrying on traditionally—backed by the performance of such mechanical equipment as Sloan Flush Valves.

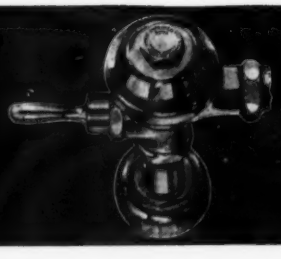
Even after serving faithfully for 31 years, Mr. Snodgrass reports that the "Sloan Flush Valves of the Claypool are just as good as when installed."

With unequalled dependability of operation and with maintenance costs as low as ¼ of 1c per Valve per year, your choice of Sloan will assure you of the best in Flush Valves.

Remember—there are more Sloan Flush Valves sold than all other makes combined.

SLOAN VALVE COMPANY • CHICAGO 24, ILLINOIS

The Sloan Valve Company has been awarded the Army-Navy "E" three times for excellence in War production.



Is this one big enough for you?

★ *ASA Standards cover welding neck flanges only in sizes through 24". But the big boiler and pressure vessel people often require huge ones like this, and for more than 25 years Taylor Forge has been the leading maker of such flanges.*

Obviously, problems in connection with the design and fabrication of boilers and other pressure vessels are closely related to those in the piping field. We ought to know, for we've had a lot of experience in both.

YES, through the years we have tackled — and solved — a great many unusual problems. Each has added its contribution to our knowledge of what constitutes good piping design. Many have required the development of special forging techniques.

This accumulated "know-how" has been drawn upon fully in both the design and manufacture of our standard line of WeldELLS and other Taylor Forge fittings for pipe welding. It has resulted in fittings of advanced engineering design with features which add to their strength, service life and convenience—others that lower their installation cost.

Take WeldELLS for example, and check the list of features at the right. Are there any *you* would omit? Can you think of another you would add?

Most piping men today, we believe, will agree that:

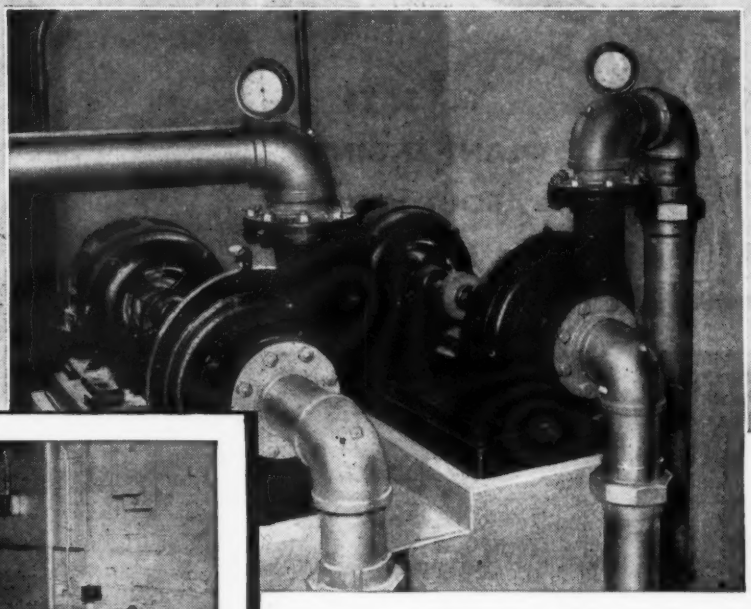
WeldELLS alone combine these features:

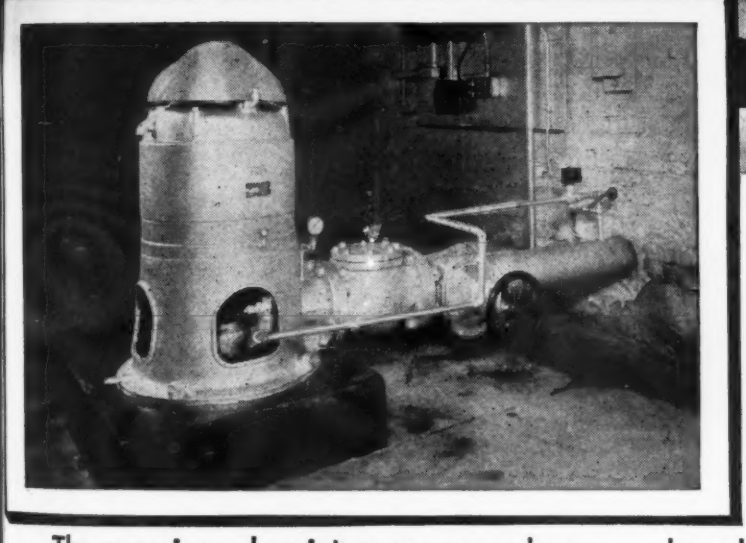
- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends** —simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** — assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

Pump Absenteeism
CAN BE PREVENTED





(above) Deming Side Suction, Two Ball Bearing Centrifugal Pumps are built in 21 different sizes from 1 to 10 inches covering a wide range of capacities from 10 to 3600 gallons per minute against heads up to 260 feet. Various other types of Deming Centrifugal Pumps provide unusually wide selection.

(left) Deming *Water Lubricated* Deep Well Turbine Pump shown with unit drive head. Also built with belt drive head, combination motor and belt head, flexible coupling head, and speed increaser gear head. Capacities range from 15 to 3000 gallons per minute.

The experienced maintenance man who respects and cares for pumping equipment pleads: *"Give me the right type and capacity of pump and I'll see to it that there's no pump absenteeism in this plant!"*

In that important "first step" in preventing *"pump absenteeism"* (operating failure) the Deming Distributor in your area is in an unusually strong position to co-operate.

One big factor is the exceptionally wide variety of TYPES and CAPACITIES of *standardized* Deming Pumps. Very often, the Deming Distributor, after knowing the exact conditions, can help you avoid the expense of specially designed equipment by selecting a standard pump exactly designed for the requirements.

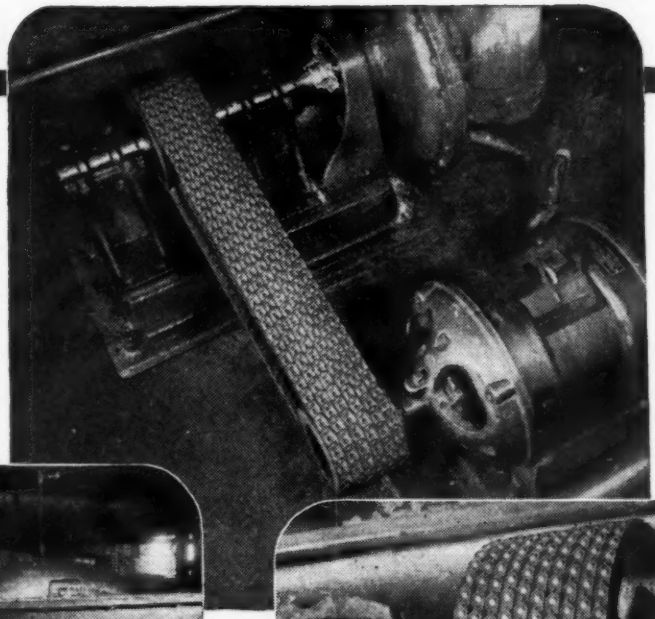
In addition to numerous types of centrifugal pumps and deep well turbines, the complete Deming line includes all types of shallow and deep well pumps and water systems, rotary and oscillating pumps, high-pressure pumps, condensation return units, sump pumps, cellar drainers, and many others.

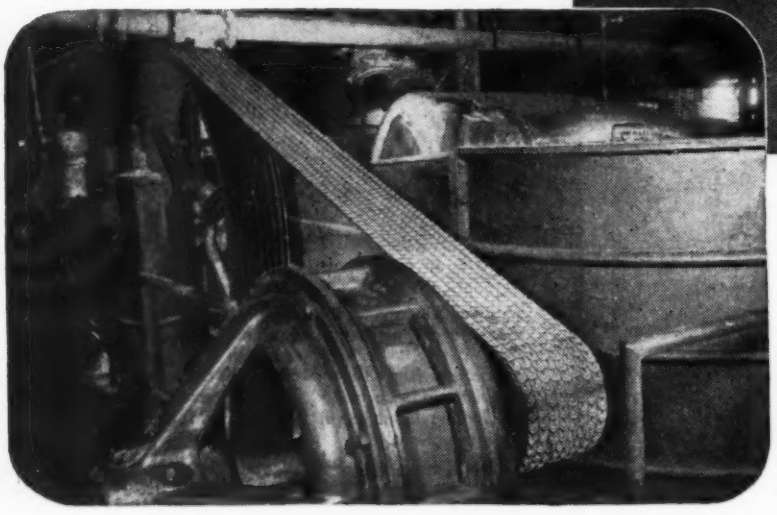
Back of every Deming Distributor is an organization concentrating 100% of its activities on the job of designing and manufacturing high quality, dependable pumping equipment.

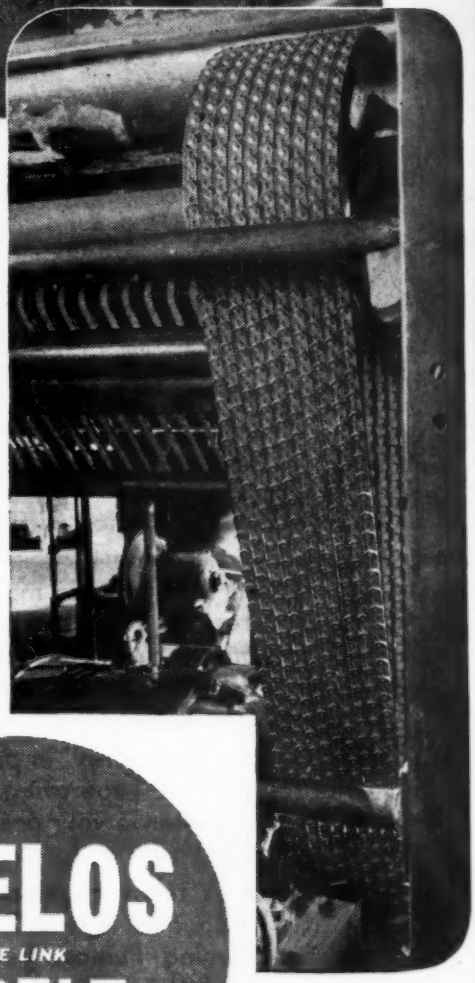
THE DEMING COMPANY • SALEM, OHIO, U. S. A.

"Easier to Install"

. . . SAYS PLANT ENGINEER ABOUT VEELOS







ON drive after drive in a big Eastern paper mill . . . over a wide range of equipment . . . under a variety of service conditions . . . you'll find that the belt used is Veelos. Beater . . . re-winder . . . sheeter . . . pump . . . this adjustable, link V-belt drives them all with maximum efficiency.

When asked *"Why Veelos?"*, the plant engineer replied, *"It's easier to install."* He was talking straight to the point! Easier installation is one of the big advantages provided by Veelos link construction. Among the others are:

1. Adjustability to End Slippage: Veelos link construction provides quick, easy tension adjustment to end slippage.

2. Controlled Tension Protects Bearings and Belts: Control of tension on each individual strand permits uniform, controlled tension in the entire drive. This protects bearings as well as belts.

Learn How Link Construction Ups Production

Write today for free 8-page illustrated manual giving Veelos applications, construction detail, installation directions and engineering data.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

YOU CAN ALWAYS COUNT ON EXIDES

FOR DEPENDABLE DIESEL CRANKING

Engineers and operators of Diesel equipped power plants know that they can always count on Exide Batteries for trustworthy performance . . . that when Exides do the cranking, Diesels start. A result to be expected, for Exides are designed specifically for difficult cranking jobs.

Exide Batteries for cranking Diesel engines are a result of long and exhaustive research. Their development through the years has kept pace, step by step, with Diesel development. Their abundant power is assurance of dependable performance in all climates, and their rugged construction assures long-life and ease of maintenance.

Write for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Heavy-Duty Batteries.

ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

NO MAGIC...

There is no magic remedy for water conditioning troubles in your plant

BIRD-ARCHER

offers an intelligent
modern . . . complete service in

INDUSTRIAL WATER CONDITIONING

for steam or process requirements based on knowledge, experience, research and chemical laboratory analysis.

Write for our latest booklet on Water Testing Equipment for Power Plants and Methods of Procedure

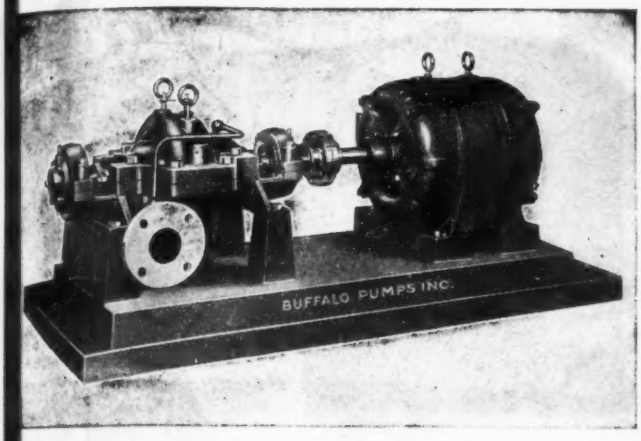
Consultation . . . without obligation

THE BIRD-ARCHER CO.

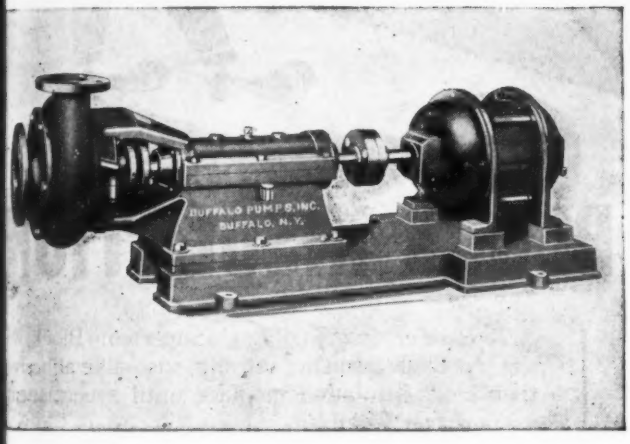
NEW YORK 17, N. Y. • CHICAGO 11, ILL. • PHILADELPHIA 40, PA. • MONTREAL, CAN.

SURVEYS • PLANT STUDIES • CONSULTATIONS • TREATMENTS
PLANT DESIGN • SUPERVISORY SERVICE • LABORATORY SERVICE

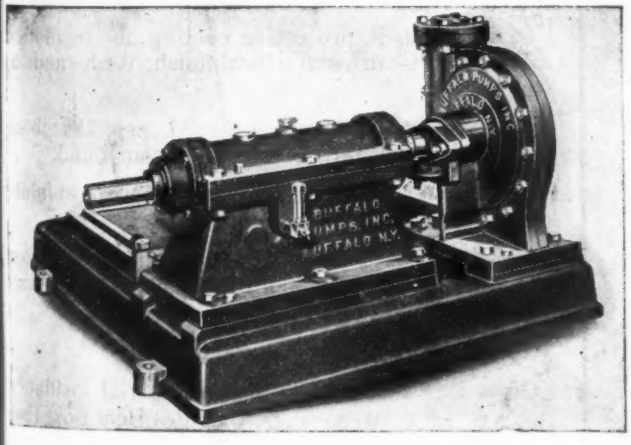
Three popular pumps—



Buffalo Class "RR" Pumps are commonly used for boiler feeding and general service where clear water is handled. They are built in two- and four-stage models, with single suction impellers mounted back to back, so that practically perfect hydraulic balance is obtained. Extra heavy duty construction is a feature of this line; all parts are amptly proportioned so that continuous operation is practical. "RR" pumps are efficient;—the No. 3 two-stage, for example, handles 400 gpm against 500 feet head at 3500 rpm, with an efficiency of 75%. Complete information on "RR" pumps is contained in Bulletin 980.



Buffalo Single Suction Full Ball Bearing Pumps are paper mill and chemical plant favorites. Available with open or enclosed impellers, for construction in iron, bronze, stainless steel, nickel, Hastelloy "B" and "C" and other machineable alloys, but not in all lead, these pumps also feature heavy-duty construction for hard service. Stuffing boxes can be modified to suit each particular applicaton, and can be supplied with water seal and also with mechanical rotary stuffing box seals. Shaft is protected from wear by a removable shaft sleeve. Shaft flinger provides additional bearing protection. Full details on these pumps are contained in Bulletin 982.



Buffalo Lead Acid Pumps have enclosed impellers and full ball bearing construction. They are used for hot or cold sulphuric acid, sulphurous acid, alum, ammonium sulphate and copper sulphate. Stuffing boxes are not less than 3" deep, and are made to suit each specific installation. Impeller and pump casing are designed so that even when of all-lead construction relatively high impeller speeds and casing pressures are easily withstood.

While designed primarily for all lead construction, these pumps can also be built in all iron or special alloys. Full details on construction are in Bulletin 982.

Buffalo Pumps, Inc.

488 Broadway **Buffalo, N. Y.**

Canada Pumps Ltd., Kitchener, Ont.

ARMY E NAVY

"Buffalo"

Centrifugal Pumps

An Efficiency Expert for your heated equipment!

EAGLE SUPERTEMP BLOCK INSULATION

As a low cost, all-purpose block insulation, Eagle Supertemp prevents heat loss and steps up the efficiency of boilers, heat treating furnaces, turbines, hot air ducts, hot water tanks, ovens, and other heated equipment.

Because it is composed principally of Eagle Mineral Wool, Eagle Supertemp Block is literally honeycombed with dead air cells, one of the best heat insulators known to science. This unique insulation withstands a full range of temperatures up to 1700° F. The chemical and physical stability of Eagle Supertemp Block makes its low thermal conductivity permanently effective. This insures continuing savings long after the initial cost has been repaid.

Installs Quickly

Eagle Supertemp Block has ample structural strength to withstand all normal handling and usage. It can be installed quickly, cuts easily with knife or saw, and fits snugly over minor irregularities, such as rivet heads.

Virtually fireproof and highly moisture-resistant, Eagle Supertemp Block contains nothing to cause rust or corrosion, most important these days when so much metal equipment is impossible to replace.

To speed application of Eagle Supertemp Block, we suggest Eagle Insulstic, a strong, paste-like adhesive that holds insulation in place until a permanent support can be added.

Other Eagle Industrial Insulations Include:

Eagle Insulseal. A protective coating for insulation. Trowels on—dries to a hard finish. Withstands up to 450° F.

Eagle Swetchek (Black). A prepared, asphaltic base, rust-inhibitive, anti-condensation compound.

Eagle Drycote (White). A dry, ready-to-mix, rust-inhibitive anti-condensation compound.

Eagle "43" Finishing Cement. A hard, white finish coating for all types of indoor insulation within a range of from 70° F. to 800° F.

FREE MANUAL!

Gives case examples of how industrial insulation effects large fuel savings. Includes Heat Loss Estimate Sheet for your use. Write for your copy.

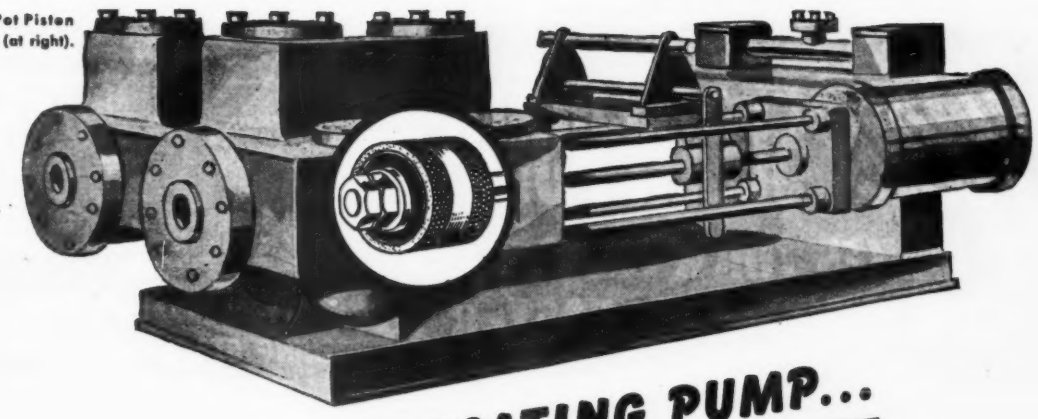
★ *Back the boys at the front with MORE War Bonds!* ★

EAGLE-PICHER INSULATIONS
High and Low Temperature

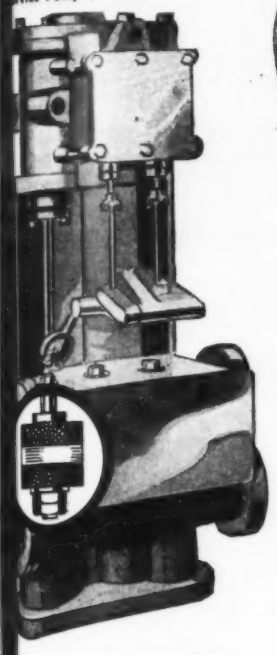
Made by THE EAGLE-PICHER LEAD COMPANY • CINCINNATI (1), OHIO

Eagle Super "66" Plastic Insulation • Eagle L-T and M-2 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek • Eagle Drycote

Twin Valve-Pot Piston Hot Oil Pump (at right).



Vertical Duplex General Service Pump (below).



EVERY RECIPROCATING PUMP...
EVERY HYDRAULIC CYLINDER...
EVERY AIR CYLINDER...

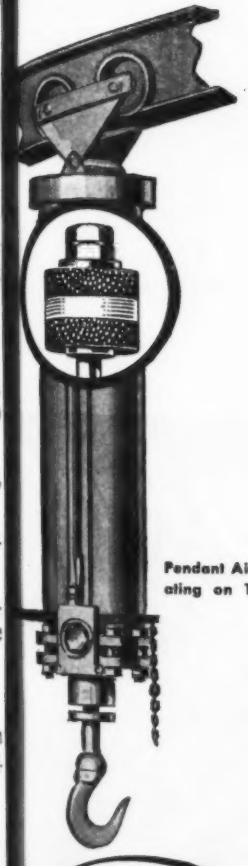
works better with

TRADE MARK PUMCUP **PACKING**

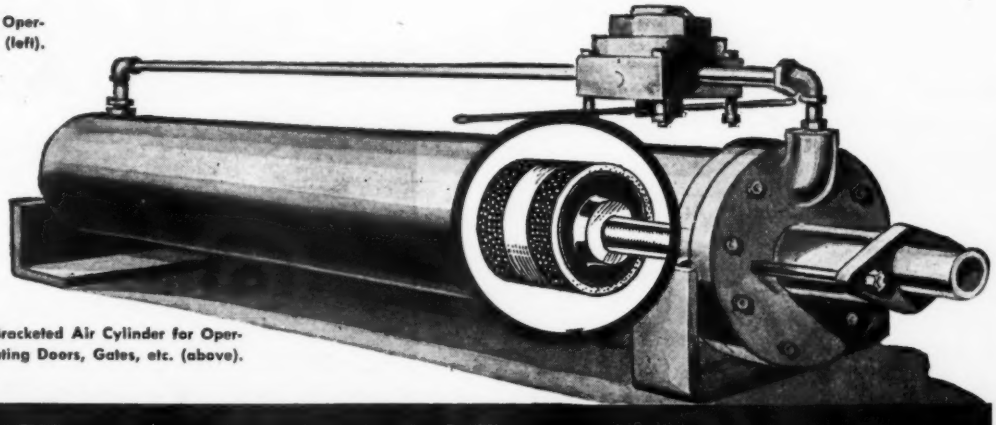
● Darcova Pumcups are long-lived composition cups for packing pistons of reciprocating pumps, pneumatic and hydraulic cylinders. They outlast other types of packing in water, oil, gas, brine, sewage, cement slurries, syrups, refrigerants, mash, chlorine, CO_2, many acids and alkalies, practically all commercial fluids.

Pumcups save "down time", cut frequency of repacking, save labor and materials. In pumps, they increase pumping efficiency, save power. They are used in hundreds of plants—refineries, railroads, power plants, chemical plants, food plants, steamships, distilleries, breweries, pipe line stations, manufacturing plants of every type.

For full information on Pumcups, send for free bulletins—No. 4401 if you have reciprocating pumps, No. 4502 if for hydraulic and pneumatic mechanisms.



Pendant Air Hoist Operating on Trolley (left).



Bracketed Air Cylinder for Operating Doors, Gates, etc. (above).

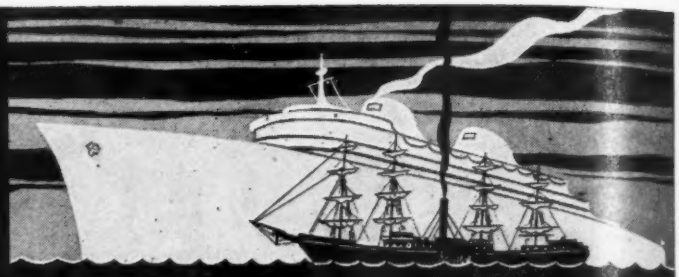
DARCOVA TRADE MARK

THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

New SCREW PUMP
MAKES THICK FLUIDS FLOW SMOOTHER, FASTER

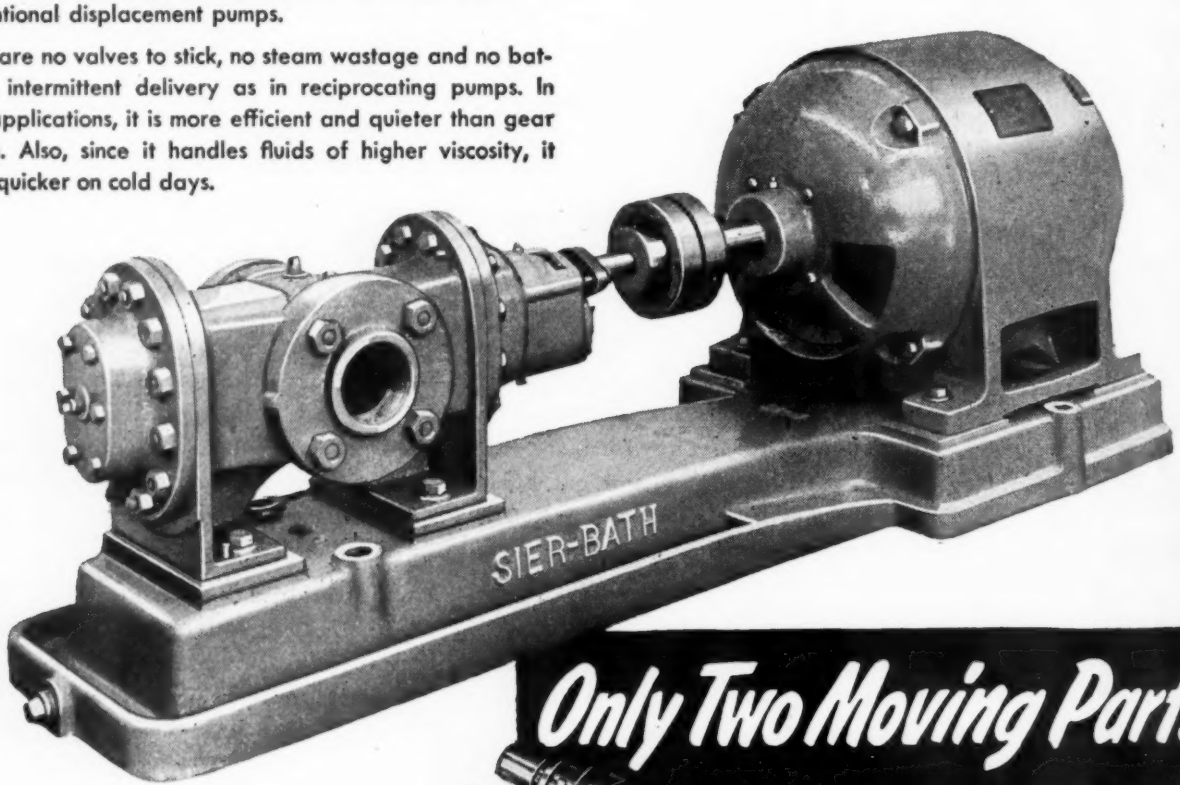


Take A Tip From The Big Ship:
"NOTHING BEATS THE THRUST OF THE SCREW"

This new Sier-Bath screw pump is as far ahead in pumping thick fluids as the twin screw propeller is ahead of the old style paddlewheel. For it applies the screw's tremendous torque to heavy fluids and thus overcomes the difficulties of conventional displacement pumps.

There are no valves to stick, no steam wastage and no battering intermittent delivery as in reciprocating pumps. In most applications, it is more efficient and quieter than gear pumps. Also, since it handles fluids of higher viscosity, it starts quicker on cold days.

When used on fuel oil lines, its pulseless discharge prevents "puffy" firing and improves boiler efficiency. Furnished in both external and internal gear types. Write for Bulletin.



PUMPS—asphalt—Bunker C Fuel Oil—greases—molasses—soaps—syrups—cellophanes—acetates.

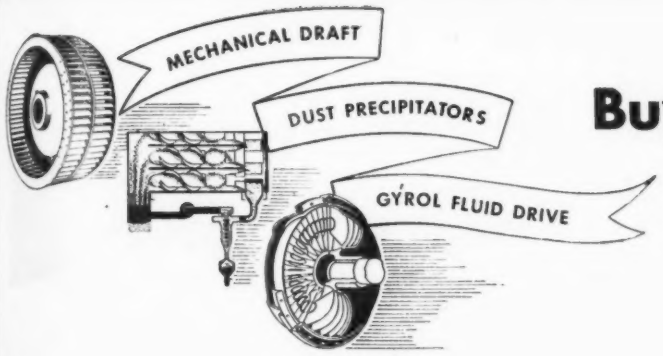
☆ *MANUFACTURING QUALITY PRODUCTS SINCE 1904* ☆

Sier-Bath Gear Co.

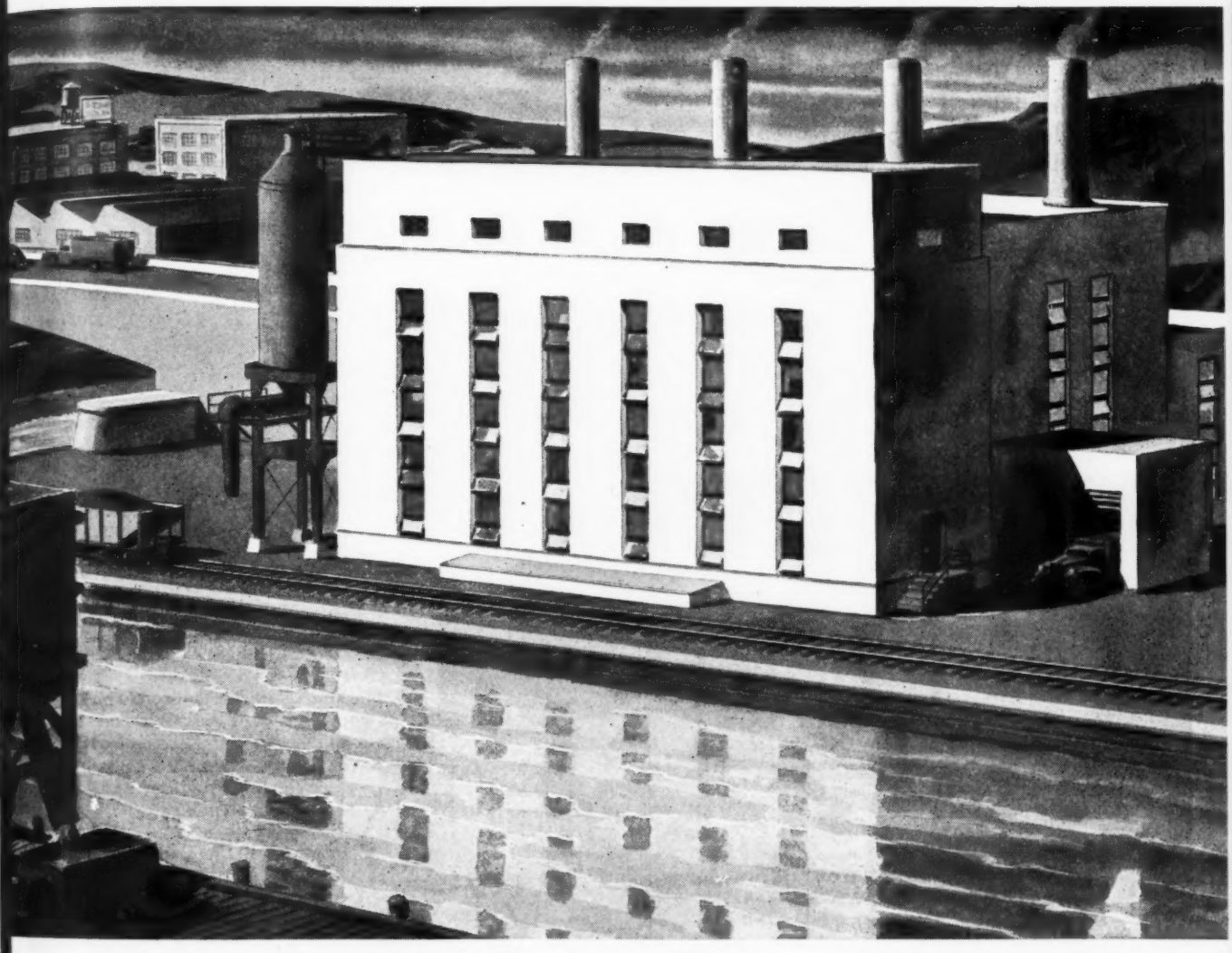
9254 Hudson Blvd., North Bergen, N.J.

Only Two Moving Parts
MEANS LOW MAINTENANCE

Two screws are only moving parts. End to center fluid movement of horizontally mounted units eliminates thrust bearings. Self-centering timing gears prevent sidewear resulting from screw contact. Packing can be added while pump is running.



Buying all 3 from A. B. C. Centralizes Responsibility



For the postwar era, America's goal is great. This will mean many new power plants . . . much modernizing of present equipment. Buying all 3 — Mechanical Draft Equipment, Dust Precipitators, and Gyrol Fluid Drive — from American Blower will centralize responsibility, cut red tape and give you one source of reliable technical information. Contact the nearest American Blower Office today.

OUR COMPLETE FACILITIES for testing and analyzing dusts of every description are always available to you and your engineers. We have one of the largest and finest Dust Testing Laboratories in the industry, with a collection of dust samples on more than 4,100 distinctly different materials. Arrange now to have your engineers run tests in our laboratories. No dust problem is too large or too small for our careful attention. There is no charge for analyzing and testing dust, but there is a big benefit to be derived from this procedure if you do it before you buy Dust Precipitators or Collectors of any make or type. Phone or write American Blower today.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Division of American Radiator & Standard Sanitary corporation

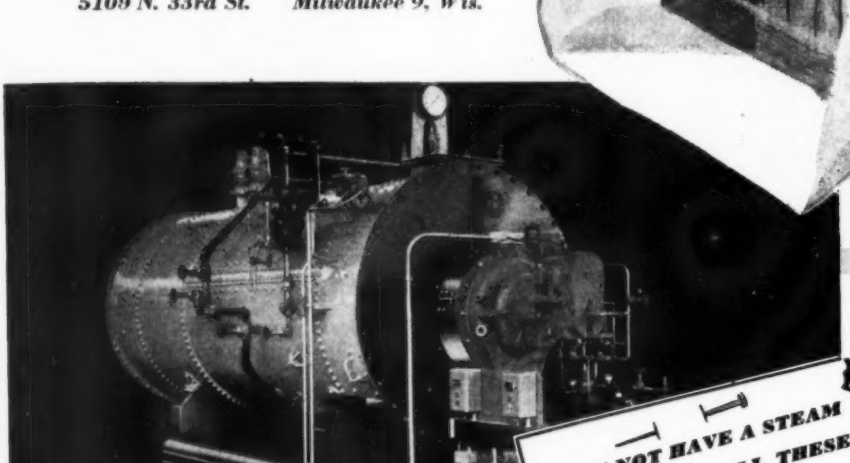
Packaged

● Shipped as a complete, ready-to-operate "packaged" unit—factory-finished and tested —with boiler, integral oil-burner and all controls built into one complete assembly, a Cleaver-Brooks steam generator vastly simplifies steam plant purchase and installation.

Responsibility is centralized — you deal with one company. A Cleaver-Brooks engineer analyzes your load conditions, space and equipment arrangements, future growth needs, puts steam generator into initial operation, instructs as to operation, care and maintenance.

CLEAVER-BROOKS COMPANY
5109 N. 33rd St. Milwaukee 9, Wis.

WRITE ON YOUR BUSINESS LETTERHEAD for the Free Steam Cost-Calculator—a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.



WHY NOT HAVE A STEAM PLANT WITH ALL THESE ADVANTAGES?

• A steam-plant tailored for your job. Cleaver-Brooks analyzes your load conditions, space and equipment arrangements, future growth needs, puts unit into initial operation, instructs as to operation, care and maintenance.

• Designed for utmost convenience of operator — all controls may be operated from front of boiler. A factory engineer puts unit into initial operation, and trains your employees in operation, care and maintenance.

• One source and one responsibility for the complete generator —Cleaver-Brooks Factory-finished and tested — a fully "packaged" unit meeting all code requirements.

• Fast installation. No special foundation needed. Within 24 hours after arrival, your Cleaver-Brooks Steam Generator can be in operation.

• No smoke-stack required; simple roof-high vent exhausts combustion gases.

• Saves space, uses less plant area, fits into low headroom locations.

• Oil firing eliminates smoke, ashes, clinkers, messy boiler-room conditions.

• Low operating costs; unsurpassed guarantee:—80% thermal efficiency; 13% CO_2 gases; stack temperature not to exceed 125° F above saturated steam temperatures.

• Quick steaming—for any emergency or fluctuating loads — through high heat transfer with construction and integral oil-burner.

• Full size range is available — 22 models in sizes from 15 to 500 hp., at steam pressures from 15 to 200 lbs. p.s.i. Write for bulletin and complete information.

Cleaver-Brooks
STEAM GENERATORS

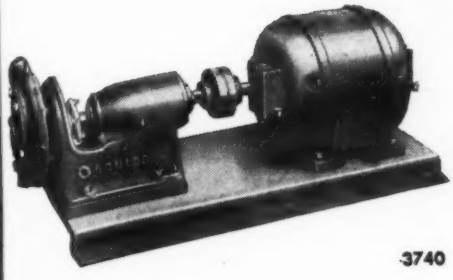
From 10 ft. Head to 3200 ft.* Head

Whatever the working head or pressure required for your pumping job, you will find the pump to meet those requirements in the Goulds complete line. But ability to provide pumps to work against a wide range of heads, isn't the sole consideration. Ability to handle the quantity of liquid in a specified time is another.

And when your liquid handling problems involve power plant service, where you need pumps for boiler feed, sump service, hot water or any other duty, you can fill every pump requirement from Goulds.

Almost a century of business life devoted to pump design and building has given Goulds engineers experience in practically every industrial field, with every type of liquid handling problem and with every practical material of construction to meet those problems.

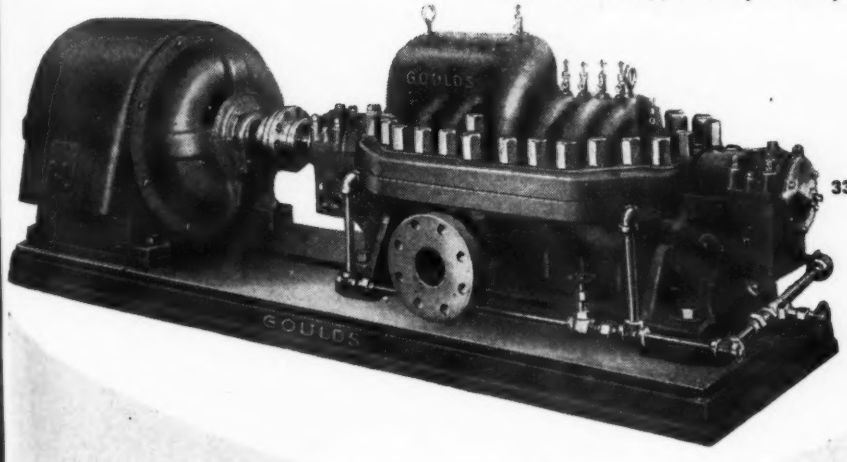
Avail yourself of Goulds engineering service, and get from Goulds complete line of centrifugal, rotary and reciprocating pumps, long life and lasting dependability in *the* Pump for *the* job.



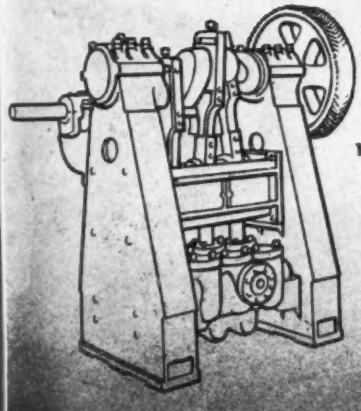
3740

GOULDS PUMPS, INC., SENECA FALLS, NEW YORK

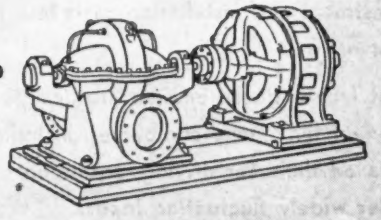
*Centrifugal Pumps. Goulds also builds Triplex Pumps for pressures up to 8000 pounds.



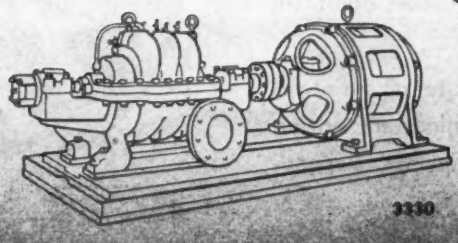
3360



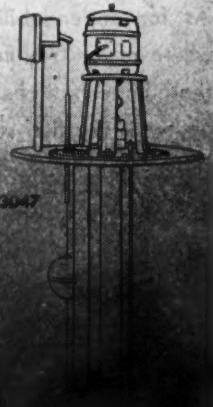
1841



3450



3330

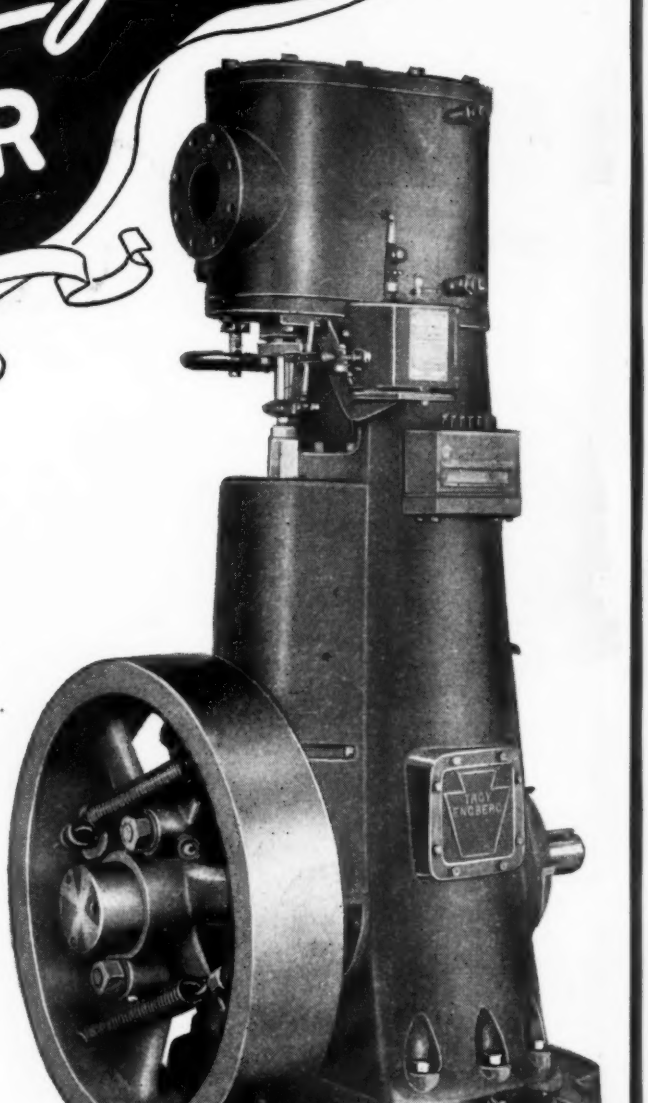


3047

Goulds

the PUMP FOR the JOB

USE Steam Engine POWER



★ FOR ECONOMY

★ FOR FLEXIBILITY

★ FOR DEPENDABILITY

Troy-Engberg Steam Engines are the most economical drive obtainable when plant heat balances are right, as they are in many plants. In these cases, generally power costs are so low as to completely pay off all investment and installation costs in a few months or a year or two.

That Troy-Engberg Engines are flexible is evidenced by the fact that many companies, including utilities, have installed them for driving stokers on boilers operating under widely fluctuating loads.

As for dependability, we refer you to oil refineries where many Troy-Engberg Steam Engines are driving those important charging and transfer pumps. Dependability is the first requirement.

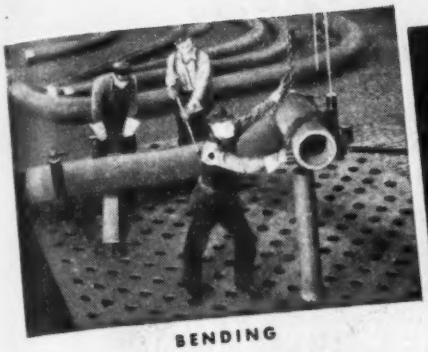
The modern reciprocating Troy-Engberg Steam Engine has so much to offer that its use should be considered for every drive in your plant. Single engines range up to 225 hp, vertical or horizontal; duplex, up to 450 hp.

TROY ENGBERG

TROY ENGINE & MACHINE CO.

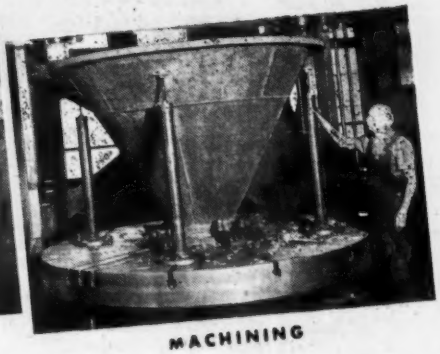
Established 1870

2503 RAILROAD AVENUE **TROY, PENNSYLVANIA**

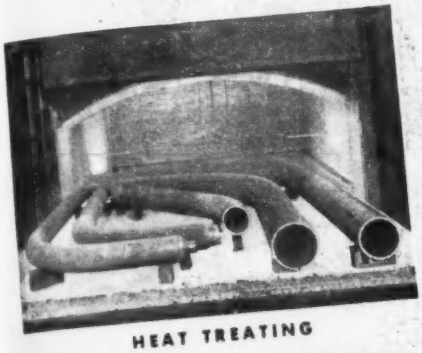


BENDING

WELDING

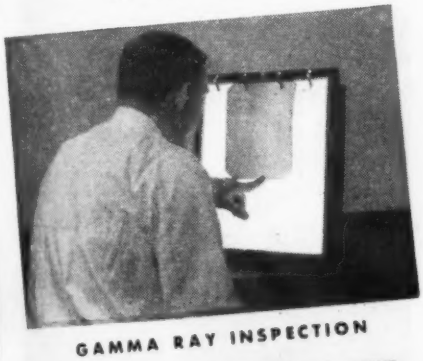


MACHINING



HEAT TREATING

STRESS RELIEVING



GAMMA RAY INSPECTION

PHOTOMICROGRAPHY

From Every Standpoint

SHOP FABRICATION

Insures a Better Piping Job

THE sharp trend to shop prefabrication of piping is not an accident. It is the natural resultant of a demand for superior workmanship coupled with economy. The stringent demands of war for speed and quality have accelerated the trend and given a dramatic demonstration of the greater efficiency of prefabrication.

Superior shop facilities are employed by skilled workmen, specifically trained in our engineering, metallurgical and manufacturing departments for the tasks they perform. Sub-assemblies are prefabricated to exact dimensions and are heat-tested, pressure-tested and inspected. The size of assemblies, prefabricated in our shop, is limited only by shipping facilities or installation space.

Shop fabrication by Pittsburgh Piping insures higher quality, greater safety, and strict compliance with code and insurance company requirements—and greater ultimate economy.

Our engineers will gladly work with you on any piping problem confronting you. Contact our nearest representative or write us direct.

Back the 7th War Loan—Buy MORE Bonds

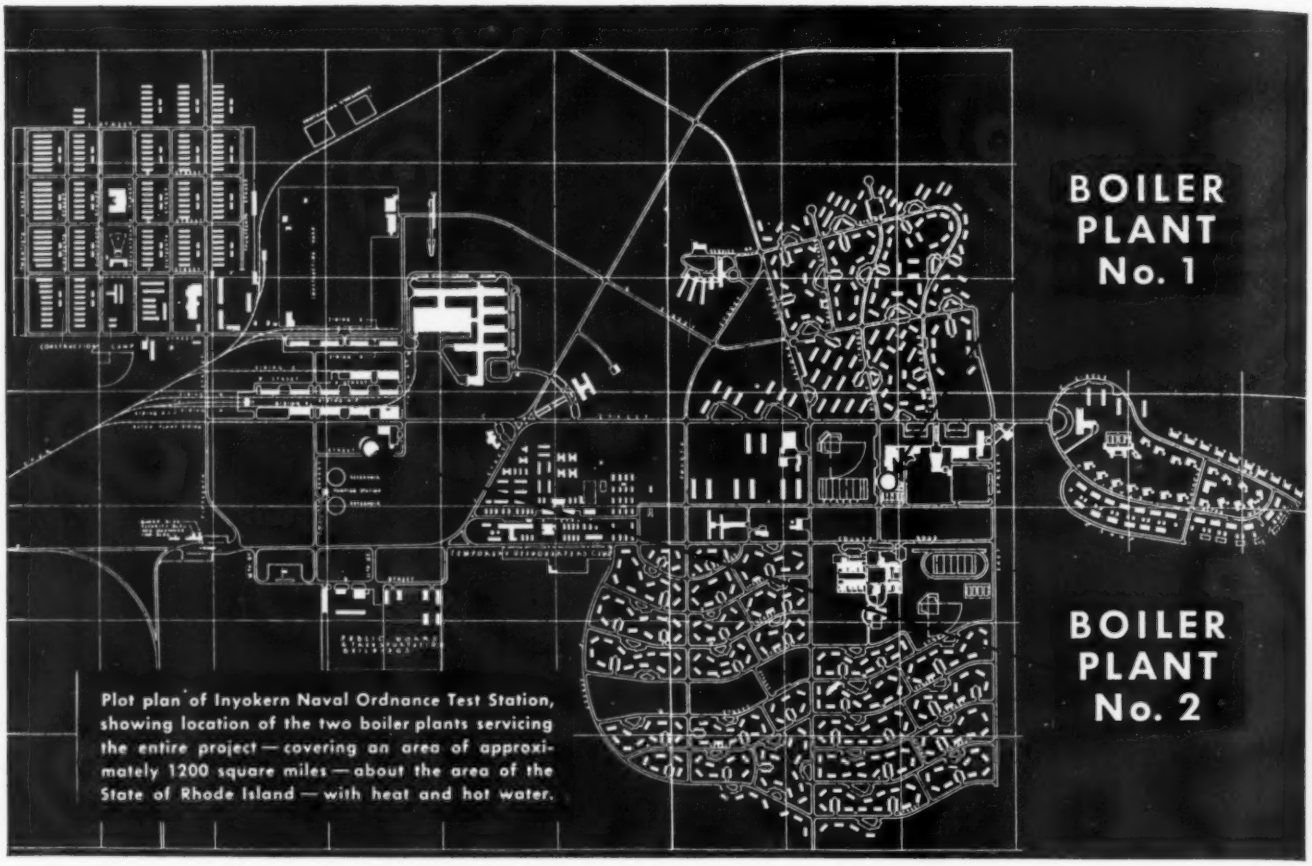
ARMY E NAVY

Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
634 S. Gramercy Place, Los Angeles



Plot plan of Inyokern Naval Ordnance Test Station, showing location of the two boiler plants servicing the entire project — covering an area of approximately 1200 square miles — about the area of the State of Rhode Island — with heat and hot water.

OVER *125,000* FEET OF RIC-WIL CONDUIT SYSTEM AT THE $55,000,000 INYOKERN NAVAL ORDNANCE TEST STATION

Heat and hot water supply for the mammoth Inyokern Naval Ordnance Test Station near Inyokern, California are provided centrally from two boiler plants, through underground distribution piping, all insulated and protected by more than 125,000 feet of Ric-wiL Conduit. The system includes 437 Ric-wiL prefabricated expansion loops. The 9500 people employed in the area are housed in several hundred buildings comprising homes, dormitories, barracks, mess halls, post-office, theatre, school and hospital—all heated and supplied with hot water from the two central sources. By using Ric-wiL products, installation time and cost were held to a minimum, and a permanent, trouble free distribution system is assured.

For Your Postwar Construction, Consider These Advantages of Central Heating . . .

- Savings of 15% or better in overall fuel consumption.
- Elimination of separate boiler tending for each building unit.
- Elimination of smoke and soot which destroy original beauty of buildings.
- Increase of available space in building basements.
- Elimination of coal delivery and ash removal from buildings.
- Uniform, clean heat provided quickly, whenever needed.
- Central unfailing source of hot water.

Engineers and architects with present or post-war projects on their boards, will find the new Ric-wiL Catalog No. 44 a valuable source of information on efficient Central Heat Distribution for institutions, industrial or commercial building groups, housing projects and municipalities.

Official U. S. Navy Photo

Distribution Piping being installed in Ric-wiL Tile Conduit at Inyokern.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS

THE RIC-WIL COMPANY · CLEVELAND, OHIO

AGENTS IN PRINCIPAL CITIES

You get knowledge and skill with ARMSTRONG'S CONTRACT SERVICE FOR HEAT INSULATION

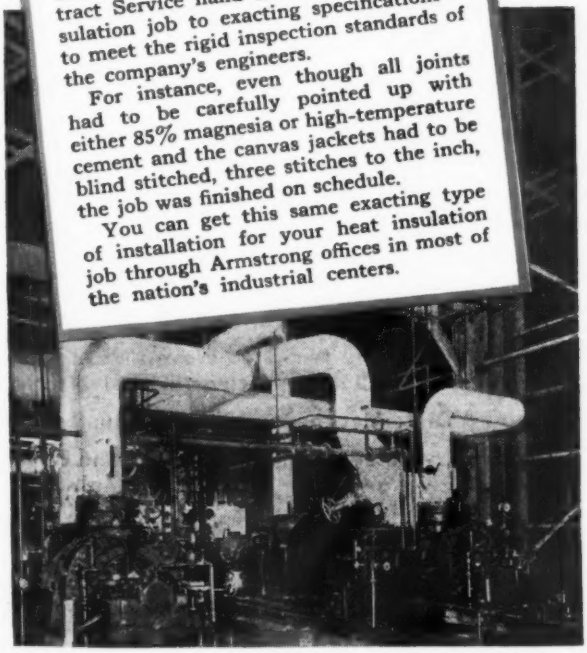
Know-How and Skill Speed Exacting Job

Units #1 and #2 of the Riverside Generating Station of Consolidated Gas Electric Light and Power Company of Baltimore had to be put in service fast to supply power for expanded war industries.

In spite of this necessary speed, the skilled mechanics of Armstrong's Contract Service hand tailored the heat insulation job to exacting specifications—to meet the rigid inspection standards of the company's engineers.

For instance, even though all joints had to be carefully pointed up with either 85% magnesia or high-temperature cement and the canvas jackets had to be blind stitched, three stitches to the inch, the job was finished on schedule.

You can get this same exacting type of installation for your heat insulation job through Armstrong offices in most of the nation's industrial centers.



THE KNOWLEDGE and skill necessary to follow exact insulation specifications are yours when you use Armstrong's Contract Service. That's because Armstrong's engineers, from their many years of varied experience, know how to handle all types of insulation jobs in accordance with modern design practice. But that's only one of the big advantages you gain from this complete service.

Armstrong offers also materials of tested efficiency, skilled mechanics for installation, and close supervision of every phase of the work. The Armstrong organization takes full responsibility for the entire job. For detailed information, write to Armstrong Cork Company, Building Materials Division, 7006 Concord Street, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

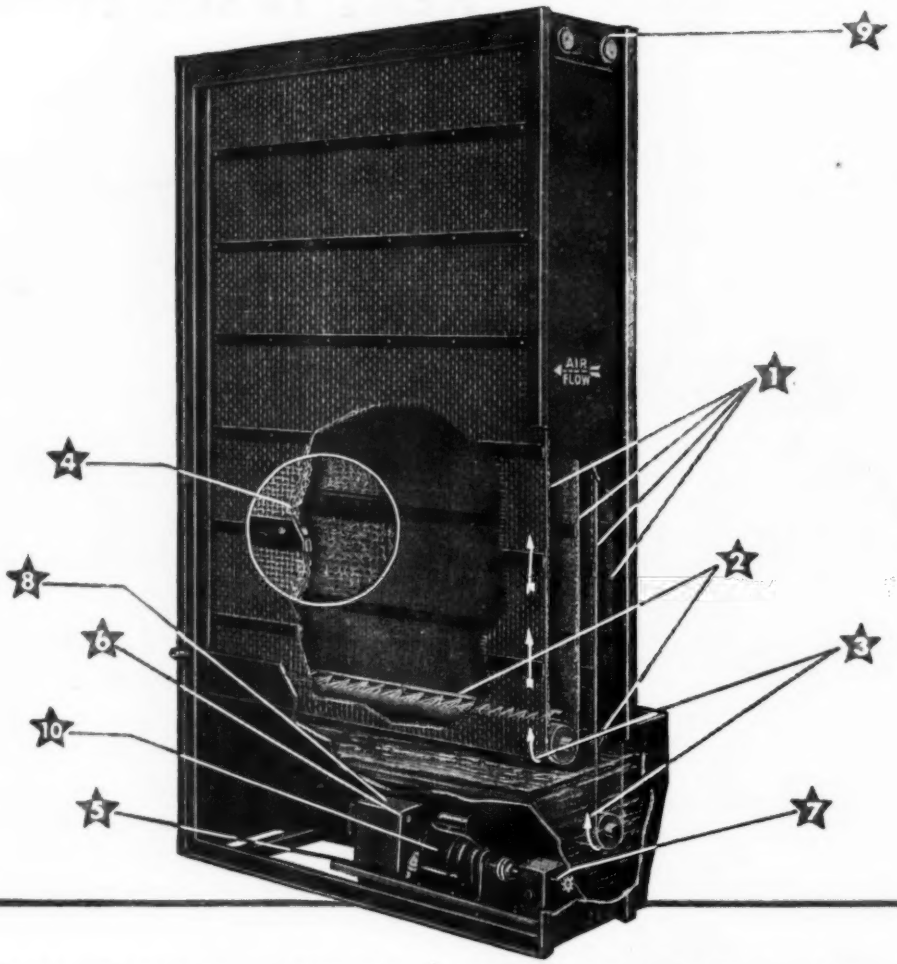
From 300° Below Zero

To 2600° Fahrenheit

STAYNEW AUTOMATIC

No other Air Filter can give you these

10 IMPORTANT FEATURES



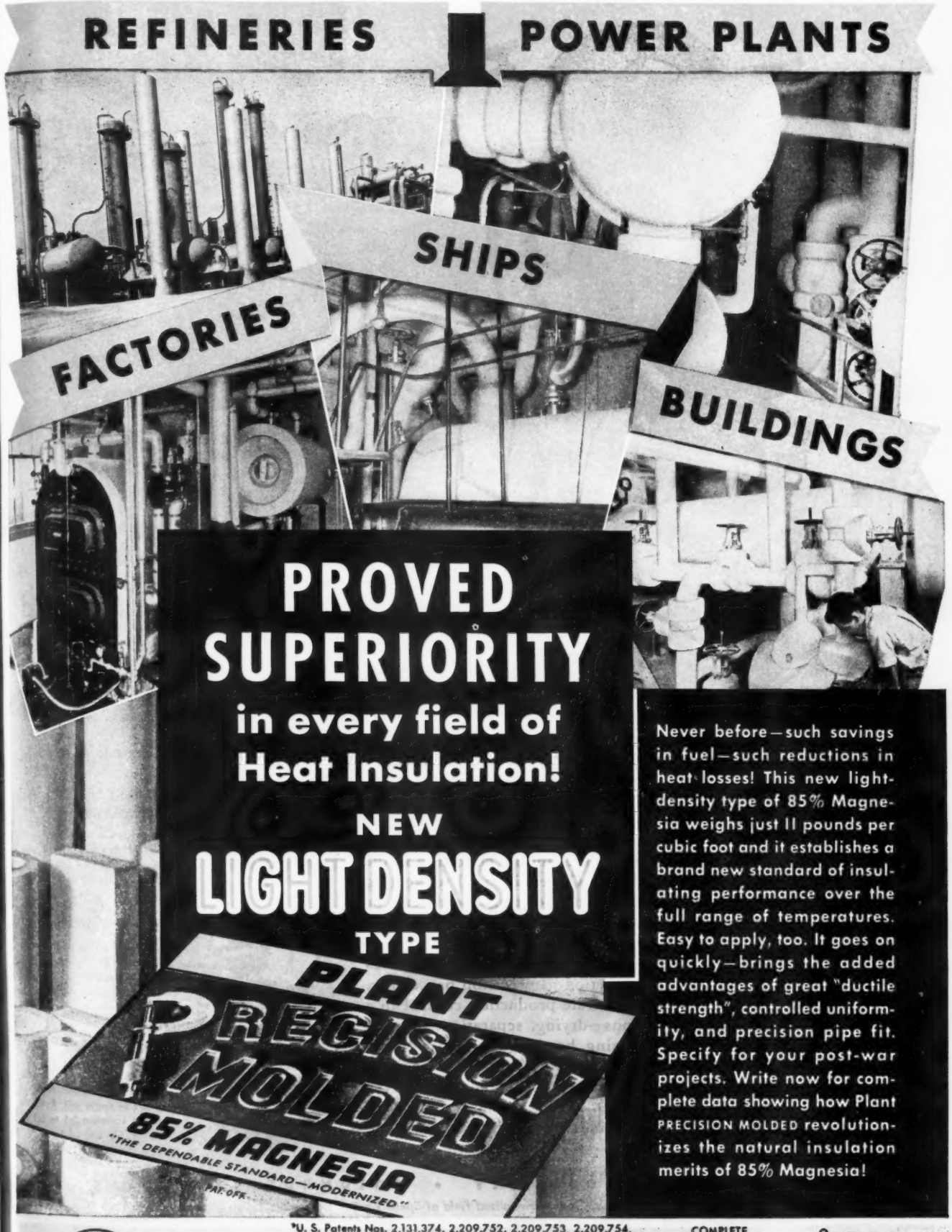
1. *Four* Stages of Filtration (Exclusive feature). The first only of *two* endless filter curtains enters the oil bath. The second, "conditioned" by the special Staynew Air Jet Cleaners, runs semi-dry and prevents oil entrainment *absolutely*.
2. Air Jet Cleaners "Condition" Both Curtains (Exclusive feature). These cleaners remove excess oil with entrapped lint, dust, etc., from the first curtain, and in the second curtain keep oil accumulation at a point where entrainment cannot occur.
3. Direction of Curtain Travel is such that air leaves *clean* side always. The Staynew is the only mechanical type air filter with this feature.
4. Efficient, Specially Designed Woven Mesh Filtering Medium, Wire Cloth Protected (Exclusive feature).
5. Motor & Drive Mechanism cushion-mounted, silent.
6. Momentary Contact Switch for testing and checking curtain travel and compressed air control.
7. Shear Pin in Drive Shaft protects moving parts from accidental damage.
8. Control Mechanism arranged for mounting as integral part of filter unit or for remote control.
9. Gear and Roller Chain Drive. *No belts to slip.*
10. Nation-wide Service on both motor and controls.

Highest efficiency of any mechanical type automatic filter

DOLLINGER CORPORATION

(FORMERLY STAYNEW FILTER CORP.)

23 CENTRE PARK ROCHESTER 3, N. Y.



PROVED SUPERIORITY

in every field of Heat Insulation!

NEW LIGHT DENSITY TYPE

PLANT PRECISION MOLDED

85% MAGNESIA

"THE DEPENDABLE STANDARD—MODERNIZED"

PAT. OFF.

Never before—such savings in fuel—such reductions in heat losses! This new light-density type of 85% Magnesia weighs just 11 pounds per cubic foot and it establishes a brand new standard of insulating performance over the full range of temperatures. Easy to apply, too. It goes on quickly—brings the added advantages of great "ductile strength", controlled uniformity, and precision pipe fit. Specify for your post-war projects. Write now for complete data showing how Plant PRECISION MOLDED revolutionizes the natural insulation merits of 85% Magnesia!

*U. S. Patents Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754.

PLANT RUBBER & ASBESTOS WORKS

MAIN OFFICE: SAN FRANCISCO

SALES OFFICES in Los Angeles, Wilmington and Oakland, California and Houston, Texas; distributors in principal cities.
FACTORIES in Emeryville, San Francisco and Redwood City, California.

COMPLETE RANGE OF SIZES and thicknesses in blocks and pipe coverings (up to and including 18 inch pipe size in sectional form. Larger sizes in segmental form).

Army-Navy "E" Awarded to FACTORY No. 3 Emeryville, Calif.

Manufacturers of Plant Insulating Materials and Mechanical Packings. Established 1898.

PROPAGATING LIFE-SAVING PENICILLIN

● In the propagation of Penicillin, the miracle, life-saving drug, it has been found that the Rotating Tanks used in the process must be driven at speeds which are *infinitely and accurately* variable.

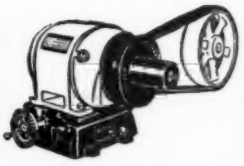
To insure the exact speed required for each changing condition in the process, The Graver Tank & Manufacturing Co. equips its Propagating Tanks with REEVES Vari-Speed Motor Pulleys. Rotating speeds can be adjusted instantly and to fractional r.p.m., while the tank is in motion, merely by turning the REEVES handwheel.

Here, again, the smooth, accurate, stepless speed adjustability of REEVES Speed Control makes an important contribution to precision processing. REEVES Speed Control is the answer to accurate production control in a large number of manufacturing operations—drying, separating, feeding, cutting, drilling, stamping, conveying, mixing, heating, cooling, winding, etc. It is standardly provided on 1,866 different makes of driven machines. Look for the familiar REEVES handwheel on any new machine you buy. It is your assurance of greater versatility, uniform quality and larger output of production. Easily installed, too, on machines in service. For complete information, send for Catalog PG-450.

The 3 Basic Reeves Units

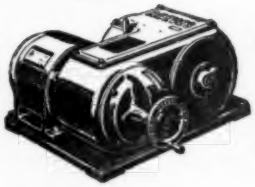
VARIABLE SPEED TRANSMISSION

Provides infinite, accurate speed flexibility over wide range—2:1 to 16:1 inclusive. Sizes fractional to 87 h.p.



VARI-SPEED MOTOR PULLEY

Converts any standard constant speed motor to a variable speed drive. Ratios of speed variation within 4:1. Sizes to 15 h.p.



MOTODRIVE

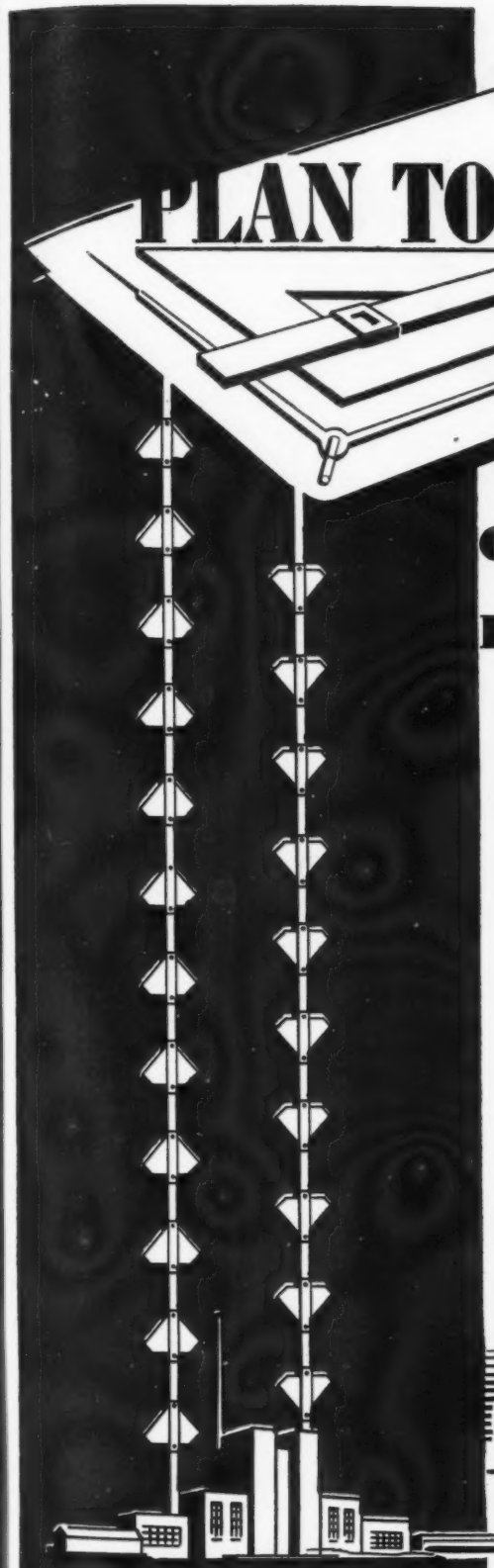
Combines motor, speed varying mechanism and reduction gears in single unit. Ratios of speed variation 2:1 to 6:1 inclusive. Sizes to 15 h.p.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

REEVES *Accurate Variable* **SPEED CONTROL**

PLAN TODAY... to move coal the G-W way



G-W HANDLES IT

Faster • Easier • Cheaper

Low power costs and low manufacturing costs go hand-in-hand. The power plant engineer must team up with the manufacturing plant superintendent on the over-all reduction of production costs so essential in the competitive era ahead.

Since power costs start at the coal pile, the method by which coal is stored and handled becomes more vital than ever. Many power men have found the "G-W Way" a simple, practical, efficient way. G-W designs, builds, and installs any type of coal and ash handling equipment.

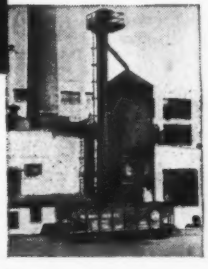
Among the G-W standard units are:

Conveyor Feeder from track hopper to elevator boot • Bucket Elevator to discharge coal to overhead storage • Screw Conveyor to distribute coal across bunker • Weigh Larry to deliver coal to pulverizer or stoker • Skip Hoist to elevate coal to storage or bunker • Coal Storage . . . Bunkers . . . Bins . . . Hoppers . . . Gates

For over 130 years, Gifford-Wood coal and ash handling systems have proved their efficiency and economy in hundreds of installations. Let G-W engineers plan with you when working out your coal and ash handling problems. The Gifford-Wood Co., 420 Lexington Ave., New York 17, N. Y.; 565 W. Washington Street, Chicago 6, Ill. Factory—Hudson, N. Y.

GIFFORD-WOOD

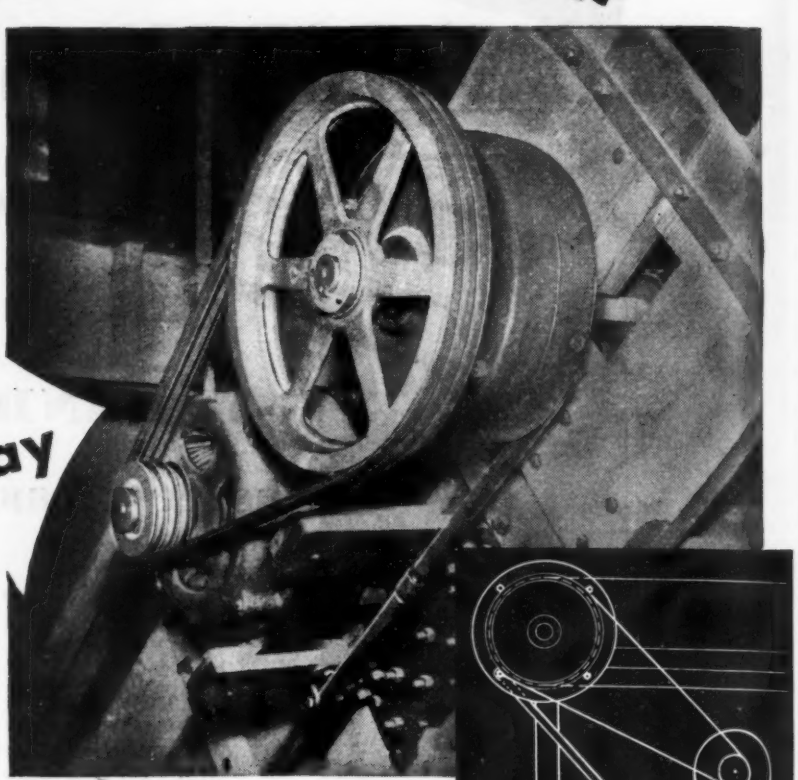
SINCE 1814



DO YOU KNOW?

G-W maintains the complete facilities of a well-organized, manufacturing plant...pattern shop, machine shop, steel, forge, paint and inspection shops . . . fully equipped with modern machinery for handling all general contract work.

GET SPEED REDUCTION This Easy Way



AMERICAN REDUCTION DRIVES Mount on the Shaft

It's as simple as that! Here are the steps:

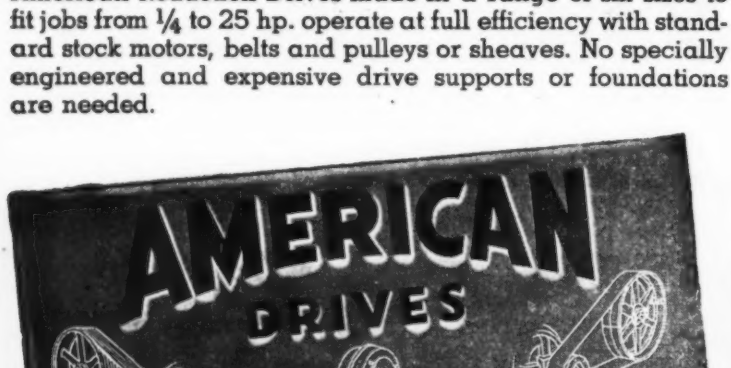
1. Mount the speed-reduction unit on the shaft of the driven machine. Bushing for output hub of the unit is furnished to fit the shaft of your machine.
2. Locate the proper size driven pulley of the primary drive on the input hub of the unit.
3. Apply the torque arm between the unit and a rigid location to prevent rotation of the speed reducer.

Just those three simple steps and your machine is ready to go—delivering any required speed between 11 and 154 rpm. Speed changes are accomplished by changing the ratio of the American Flat-belt or V-belt primary drive.

American Reduction Drives made in a range of six sizes to fit jobs from 1/4 to 25 hp. operate at full efficiency with standard stock motors, belts and pulleys or sheaves. No specially engineered and expensive drive supports or foundations are needed.

American Reduction Drives find wide use in conveyor applications as shown above. They are also used on feeders, agitators, mixers, processing and canning equipment and for many other slow-speed applications.

Send for American Reduction Drives Handbook. It gives all data necessary to apply this drive to your machinery. Typical installations, specific applications, drive selection tables and full instructions are given.



The American Pulley Company

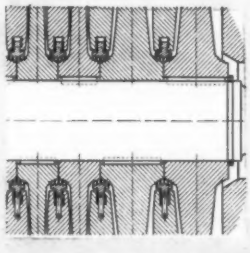
4226 WISSAHICKON AVE., PHILADELPHIA 29, PA.

WEDGBELT SHEAVES

American Wedgbelt Sheaves are made to highest precision standards of sound, strong materials. Accurately machined, carefully balanced, they assure true-running performance.

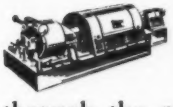
HENDY Turbine Labyrinth Seals are another dividend-paying feature

This simplified step-cut labyrinth steam seal is an exclusive feature of Hendy turbines that not only reduces interstage leakage but also contributes to shaft rigidity and rotor disk strength. A shorter and stronger turbine is possible with this method of sealing, since each disk is butted against the adjoining one.



The four-piece sealing blocks are soft leaded bronze, flexibly located, with leaf springs applying pressure from the diaphragm grooves. This feature in Hendy turbines contributes to longer operating life and higher over-all efficiency. Watch succeeding advertisements for other dividend-paying Hendy features.

When requesting data on Hendy turbines or turbo-generating plants please indicate type of service involved, electrical requirements, and steam conditions.



The development of this highly efficient steam-sealing method is the result of Hendy experience gained through the mass production of 4000, 6000 and 8500-hp turbines, and large numbers of turbo-generator sets for the Maritime Commission.

Simplified governor and speed control, and rocker-shaft operation of the valve mechanism are other Hendy turbine features. Combined with the labyrinth seals and simplification of design throughout the entire unit, they raise operating efficiencies and reduce maintenance and service problems. Two-color reprints showing details of these features are available upon your request.

Hendy turbines are available as separate power units for marine or industrial applications, or, as complete turbo-generating plants in a wide range of sizes.

Submit your power problem to any Hendy office. They will gladly help in its solution.

JOSHUA HENDY IRON WORKS
ESTABLISHED 1856
SUNNYVALE, CALIFORNIA

Branch Offices: WASHINGTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · NEW YORK · LOS ANGELES · DETROIT · PHILADELPHIA · PITTSBURGH · SAN FRANCISCO · BOSTON

Many problems . . .
Four solutions

In every power plant, as in many other kinds of plants, the operations of screening, sizing, separating and dewatering pose a number of problems . . . problems at times unique to that particular installation.

The superintendent knows what he must accomplish to insure having coal, coke or other materials in the capacities and sizes he requires. But—and this is understandable—he may not know precisely what type or types of Screens he needs to get what he wants.

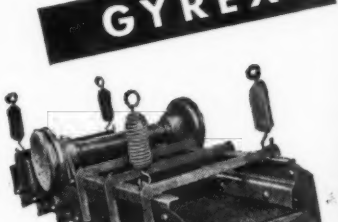
That is where Robins comes in. First of all, each Robins Sales Engineer is an engineer—trained and experienced in understanding objectives and knowing how they can be attained. Next, he has at his disposal four distinct types of Vibrating Screens, each available in a number of styles designed to serve some specific portion of your overall screening demands. In addition, he has a wide selection of Robins Screen Cloth—in meshes and weaves adequate for every purpose.

From all of this, Robins is able to supply practically any plant—large or small—with the exact answers to all its screening problems, be they simple or complex.

In turning to Robins for your Vibrating Screens, you are dealing with the company which originated many of the basic ideas employed in modern-day Screen design. (The circle-throw principle, for example, was conceived by Robins.) So you can be certain of recommendations backed by authority and founded on experience.

Perhaps you face a problem now—or know what you want and intend to fill that want with Screens that will give dependable service for a long time. If so, get in touch with Robins. When writing, please address Dept. **P-8.**

GYREX



VIBREX J

VIBREX M

ELIPTEX

ENGINEERS, MANUFACTURERS AND ERECTORS OF MATERIALS HANDLING MACHINERY

ROBINS *makes:* BELT CONVEYORS · COAL AND ORE BRIDGES · BUCKET ELEVATORS · CAR AND BARGE HAULS · CAR DUMPERS · CAR RETARDERS · CASTINGS · CHUTES · CONVEYOR IDLERS AND PULLEYS · CRUSHERS · FEEDERS · FOUNDRY SHAKEOUTS · GATES · GEARS · GRAB BUCKETS · PIVOTED BUCKET CONVEYORS · VIBRATING SCREENS · SCREEN CLOTH · SELF-UNLOADING BOAT MECHANISMS · SKIP HOISTS · STORAGE AND RECLAIMING MACHINES AND SYSTEMS · TAKEUPS · LOADING AND UNLOADING TOWERS · TRIPPERS · WEIGH LARRIES · WINCHES · WINDLASSES

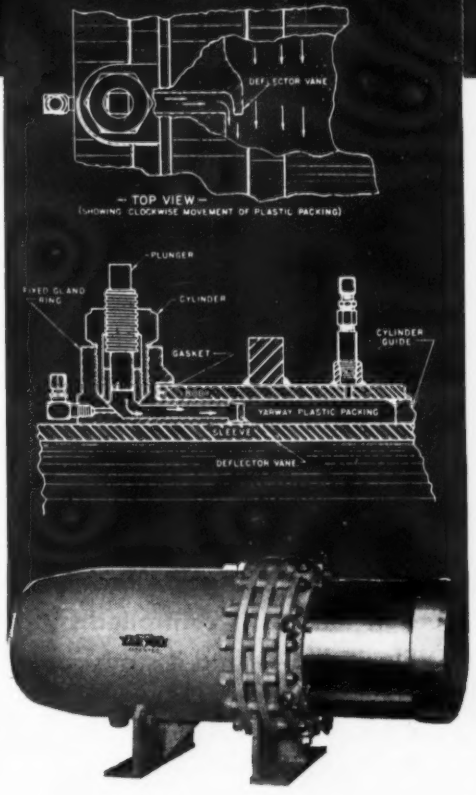
FOR MATERIAL AID IN MATERIALS HANDLING . . . . . It's **ROBINS**

ROBINS
CONVEYORS
INCORPORATED
Founded in 1896 as Robins Conveying Belt Co.
PASSAIC • NEW JERSEY

Servicing

A YARWAY GUN-PAKT JOINT

Under Full Steam Pressure



No need for costly shutdowns to repack slip-joints any more. The Yarway Gun-Pakt Expansion Joint never needs unpacking . . . is kept tight by occasionally adding packing with the joint under full steam pressure. It has been called "the greatest expansion joint improvement of modern times."

To add packing, simply insert slug of special Yarway semi-plastic packing into Gun-Pakt fittings of gland ring on joint. A twist of a wrench forces packing into stuffing box. New packing rejuvenates the old. The joint's tight . . . the job's done!

Users report tremendous savings in time, trouble, money and hard labor when they use Yarway Gun-Pakt Expansion Joints. Thousands are in service in leading industrial plants, utilities, institutions and public works.

For the full story on Yarway Gun-Pakt Expansion Joints, write for Bulletin EJ-1909.

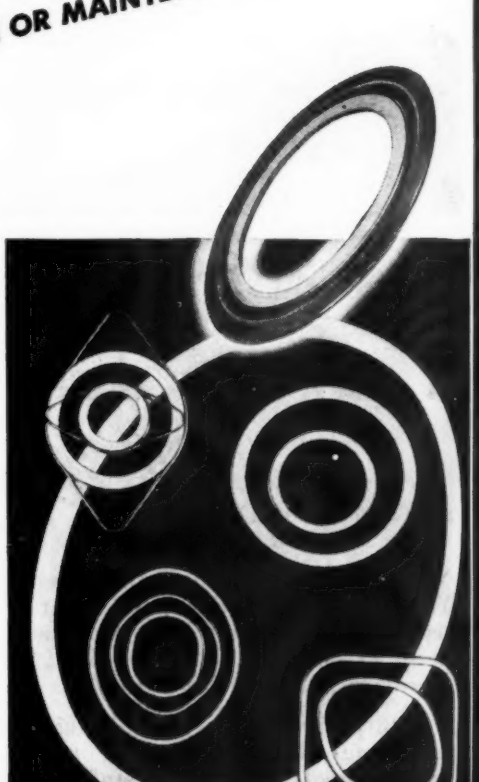
YARNALL-WARING COMPANY, 100 Mermaid Ave., Phila. 18, Pa.

Ask about the new Yarway 30-minute color and sound motion picture, with Lowell Thomas speaking—available for group showings.

YARWAY GUN-PAKT EXPANSION JOINT

WHAT IS YOUR GASKET PROBLEM?

HIGH PRESSURE—LOW PRESSURE—HIGH TEMPERATURE—LOW TEMPERATURE LIQUIDS—VAPORS OR CHEMICALS . . . FITTING STYLE OR MAINTENANCE QUESTIONS



Nothing pleases us more than an opportunity to prove that Flexitallic Gaskets can handle sealing jobs better than they've ever been handled before — and far better than is possible with either conventional or so-called "special" gasket types. That has been our sole job for 33 years.

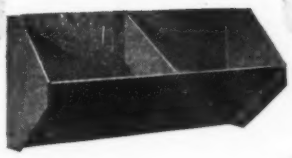
No other gasket can seal so perfectly because no other gasket incorporates the design features which make Flexitallic supreme for difficult applications. Spiral-wound construction automatically compensates for pressure surges, vibration, expansion, contraction. Bolt tension is controlled by gasket yield. Seal with Flexitallic — and it stays sealed.

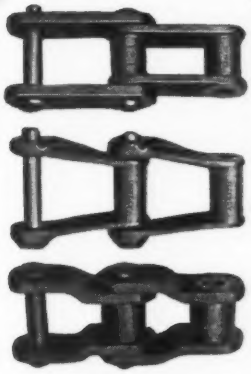
FLEXITALLIC GASKET COMPANY
8th & BAILEY STS., CAMDEN, N. J.

"Flexitallic"
REG. U. S. PAT. OFFICE

Flexitallic Gaskets are regularly supplied in styles for American standard flanges and pressure vessels of all types and for extreme pressure and temperature ranges. Our engineers welcome the opportunity to acquaint you with the possibilities of these unique gaskets for your applications.

THE ORIGINAL SPIRAL-WOUND GASKET . . . MADE ONLY BY FLEXITALLIC





For Star Performance

JEFFREY REPLACEMENT PARTS

Long years of research are behind each individual part that goes into Jeffrey equipment.

When replacement does become necessary, it's common sense to insist on parts made to the same high standards as the original equipment.

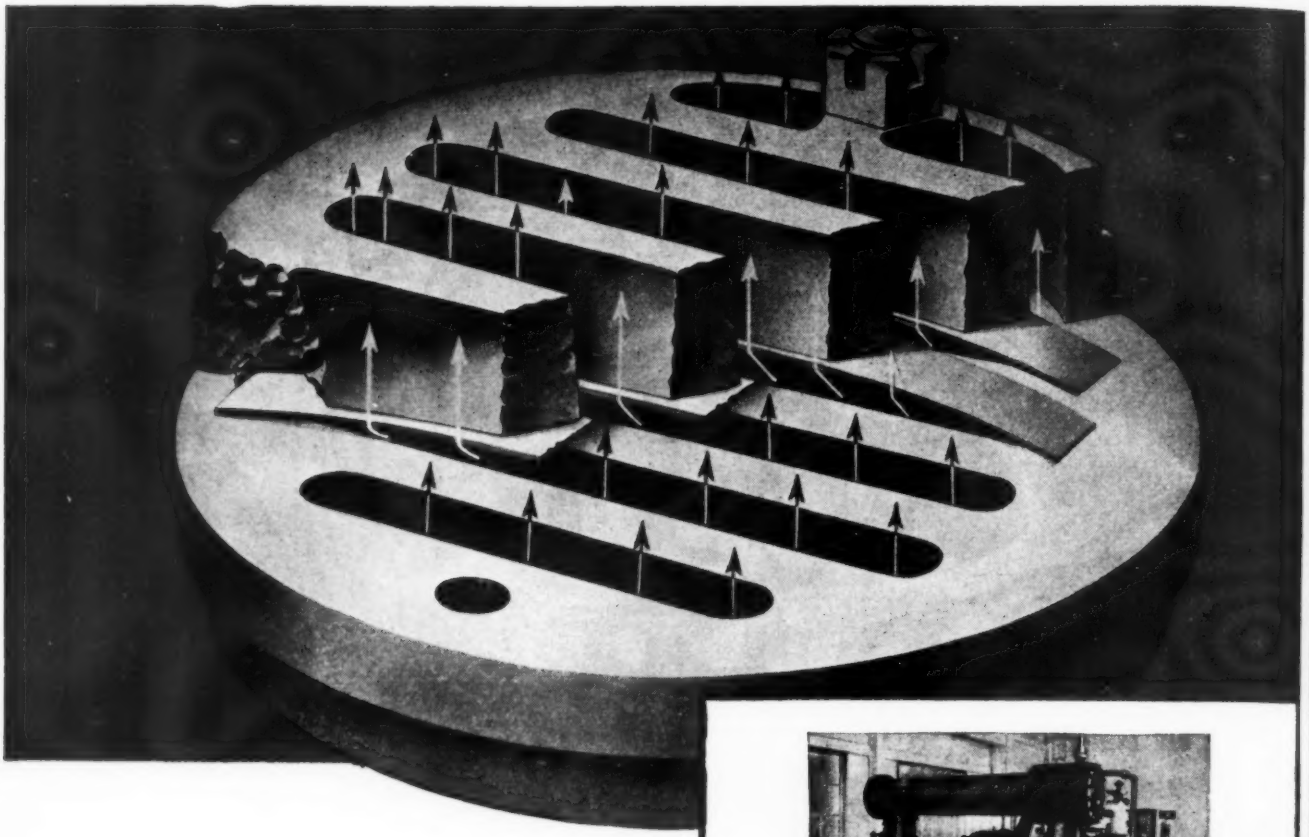
Genuine Jeffrey replacement parts can cut down installation time, insure continued smooth performance. Specify Jeffrey.

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

932-99 North Fourth St., Columbus, Ohio

Baltimore 1	Buffalo 2	Cleveland 13	Marion	Milwaukee 11	Pittsburgh 22	
Birmingham 3	Chicago 1	Denver 2	Houston 5	New York 7	St. Louis 3	
Boston 16	Cincinnati 2	Detroit 13	Huntington 19	Philadelphia 3	Salt Lake City 1	
					Scranton 3	



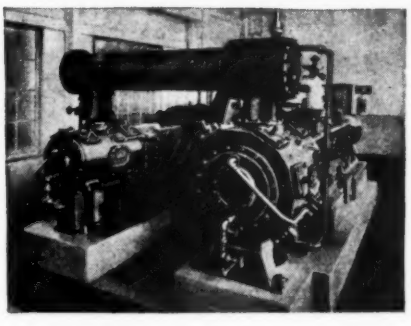
"Those Feather* Valves have never had to be replaced on our Worthington Compressors"

No wonder maintenance men endorse Worthington Feather* Valves, lightest, tightest, simplest, most durable valves ever designed for air or gas compressors. Many have given trouble-free service, without maintenance or repair, for more than 19 years!

Feather* Valves improve the efficiency of *all* Worthington compressors, including the Worthington "Angles" used on pipelines and in refineries everywhere.

The Feather* Valve is only one of many design improvements made by Worthington engineers to give you the most for your compression dollar. It will pay you to come *first* to Worthington to get the right compressor for your needs.

Worthington Pump and Machinery Corporation, Buffalo Compressor Division, Buffalo, N. Y.



COMPRESSING THE FACTS

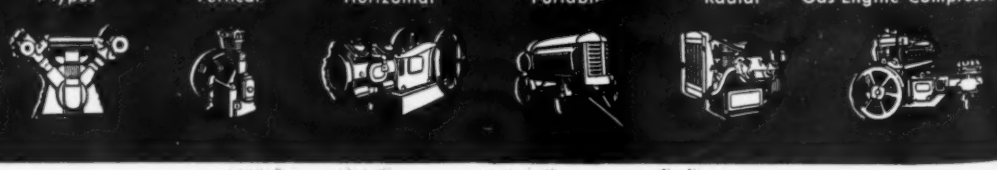
When, after 19 years, a prominent railroad decided to supplement this veteran Worthington steam driven compressor with a new Worthington opposed compressor, maintenance man reported that the original Feather* Valve strips were still giving trouble-free service!

*Reg. U. S. Pat. Off.

WORTH BEHIND THE NAME
WORTHINGTON

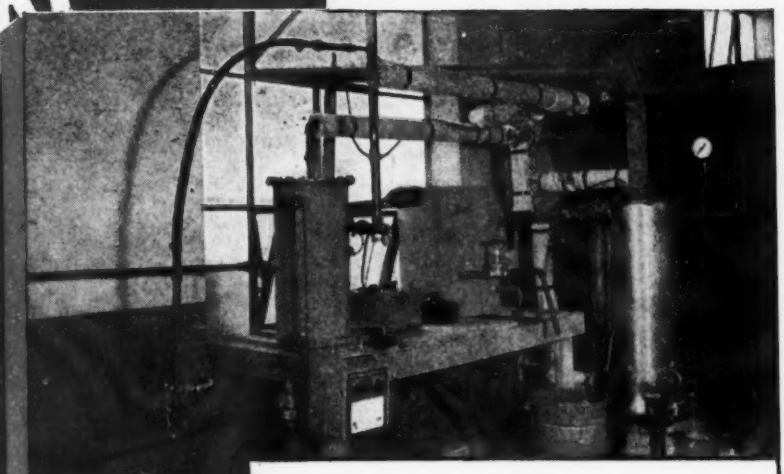
K4-14

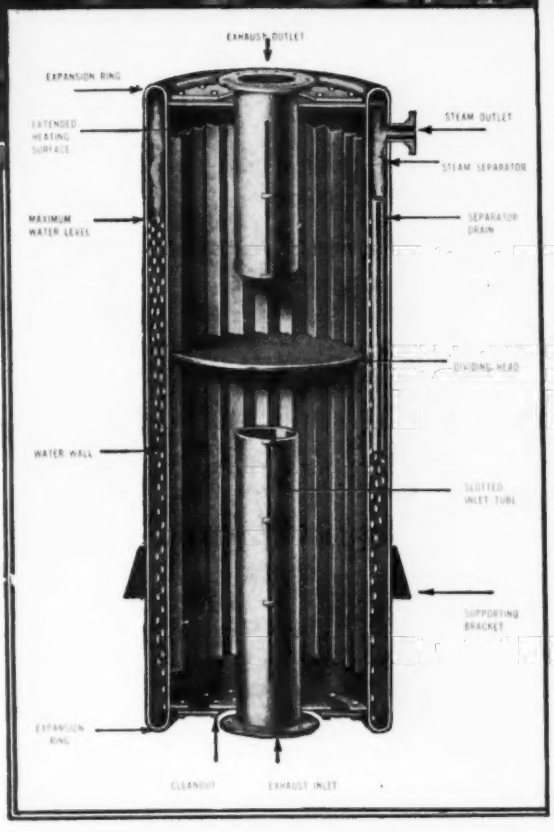
NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



PUT EXHAUST HEAT TO WORK

WITH MAXIM HEAT RECOVERY SILENCERS





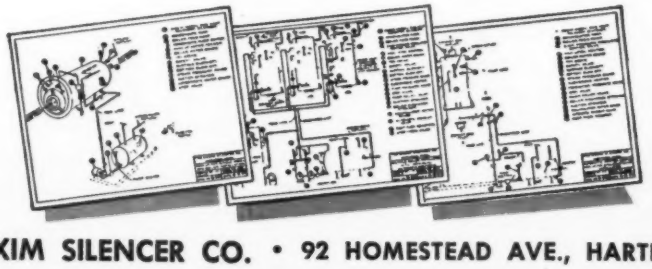
The illustration above shows a test hook-up for Heat Recovery Silencer research in the Maxim Research Department. Here again, as in Maxim Silencers, the basis for superior performance is constant and painstaking research which results in proper basic design and a never ending search for improvement.

Maxim Heat Recovery Silencers provide effective silencing of exhaust noise, 100% spark arresting (where this is desired) and the recovery of waste exhaust heat to produce steam or hot water for heating or processing operations.

These Heat Recovery Silencers are available with automatic controls which control steaming rate by varying water level in the water wall of the Silencer. They may be run wet or dry. Highly efficient heat transfer is assured by the Maxim extended heating surface feature.

●

For silencing without the heat recovery feature, Maxim makes silencers for internal combustion engine exhaust or intake, steam engine exhaust, air compressor intake, vacuum pump discharge, blower intake and discharge, high velocity steam, air or gas discharge. Engine exhaust silencers available with or without spark arrestor. Bulletins on request.



PRACTICAL WORKING HOOK-UPS

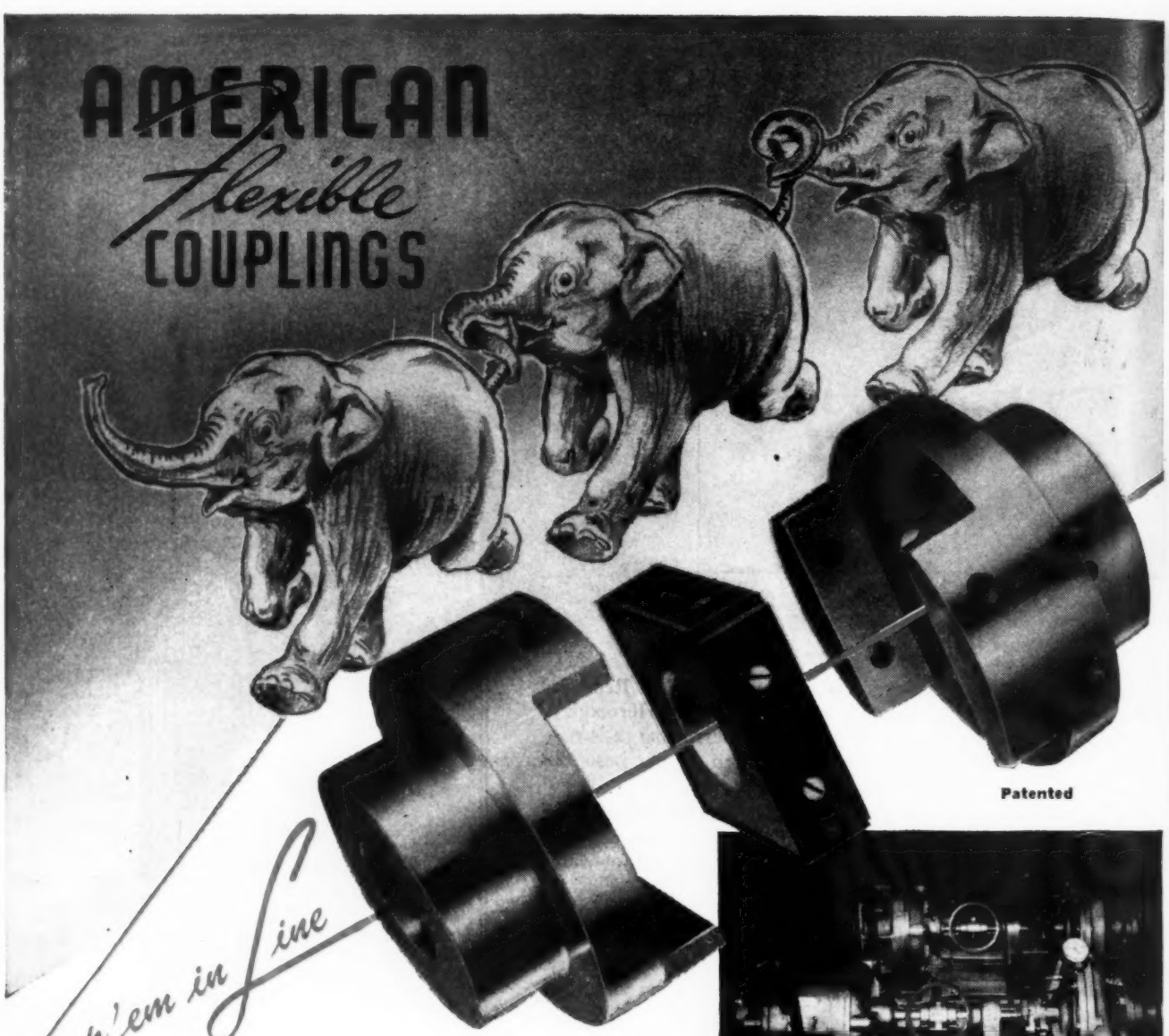
Typical Heat Recovery Silencer hook-ups are available with a detailed discussion of each. We will be glad to send them to you. Just ask for Dwgs. B-298, B-301, B-302 and B-303.

THE MAXIM SILENCER CO. • 92 HOMESTEAD AVE., HARTFORD, CONN.

ARMY E NAVY

MAXIM

AMERICAN *Flexible* COUPLINGS



Patented

Keep 'em in Line

A typical installation in a heat treating department of a large manufacturer of war material.

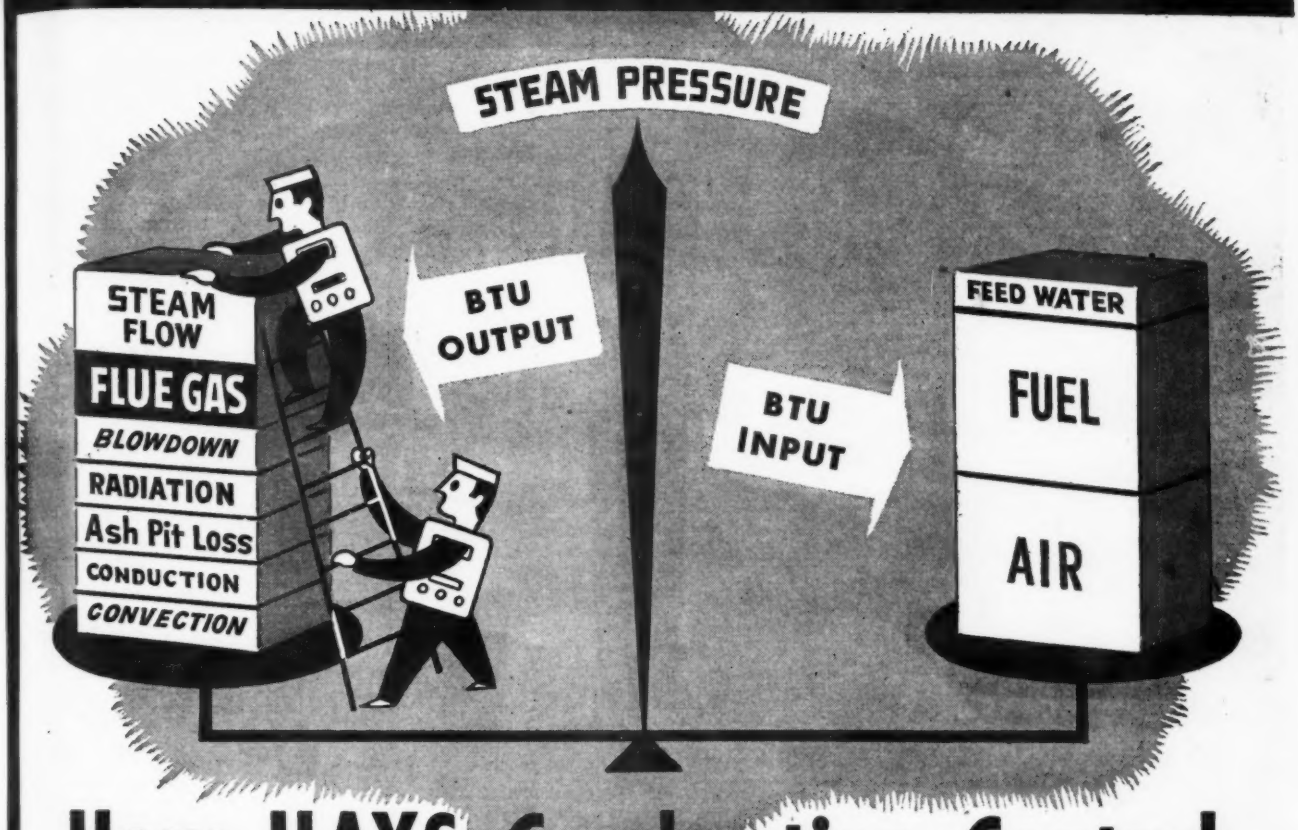
CORRECT alignment is vital to the efficient transmission of power... American Flexible Couplings are meeting all power transmission requirements efficiently . . . It's easy to see why. 3 sturdy parts only. Two identical flanges connected by a square floating center member, a centrifugal lubrication unit of high strength alloyed metals . . . The American is the only flexible coupling with replaceable bearing strips, eliminating the need of tearing down the unit . . . the reason why power men "in the know" prefer American Flexible Couplings. For full particulars on American Flexible Coupling application for light, medium and heavy duty work, write for complete catalog.

Ordnance Division

ZURN

AMERICAN FLEXIBLE COUPLING CO.
DIVISION OF
J. A. ZURN MFG. CO., ERIE, PENNA.

ELECTRICAL OPERATION IS AS MODERN AS POST WAR INDUSTRY MUST BE!



How HAYS Combustion Control balances heat in-put and out-put

...You SEE the 12 Vital Points of Modern Combustion Control in Hays Sales Visual

The most comprehensive, most understandable explanation of automatic combustion control ever compiled. Ask the Hays representative to show it to you.

1. The purpose of Combustion Control.
2. How that Purpose is accomplished—3 methods of control.
3. What results can be expected of each.
4. Elements of a *good* control system.
5. Elements of a good controller
6. *Coordinating* the controllers.
7. Selecting the best system for your needs.
8. How Automatic Combustion Control operates.
9. How each individual controller operates.
10. How controllers are calibrated and adjusted to fit requirements.
11. How controllers are stabilized to prevent hunting or over-travel.
12. Typical installations of Automatic Combustion Control.

HERE IS METERING CONTROL reduced to its simplest, most effective terms:

- A master steam pressure controller responds to changes in steam pressure and adjusts air and fuel controllers
- Air and fuel feed controllers, operated by accurate impulses from the master controller, supply the correct amount of air and fuel to maintain the steam pressure constant
- A furnace draft controller operates to hold furnace draft constant

These control units measure every slight variation in every combustion factor—and instantly adjust them ***in a precisely coordinated pattern.*** Impulses to all actuating devices are instantaneous—***because they are electrical.***

There you have it.

How that system will benefit your business—by vital savings in man-hours and steam costs—can easily be learned by consulting with Hays engineers. As a practical first step, arrange to see the Hays Visual Explanation of Automatic Combustion Control—worth seeing. Write us about it.

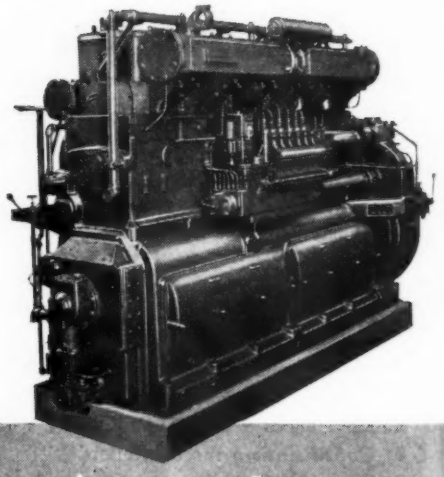
The HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

Where power means life or death!

IMAGINE yourself in a blizzard off the Grand Banks. You are in a 110-foot fishing trawler. Wind tears the crests from the waves. Spray freezes to the rigging. Heavy with ice, the little ship staggers through smashing seas. The screw rattles and races, half in air, as the laboring craft buries its nose in each foaming comber. If the engine fails...

Yes, if the engine fails. But that is one reason why more and more of these sturdy craft are powered with ALCO Diesel Engines, built for heavy duty and hard service. ALCO Diesel Engine designers pioneered in creating Diesel Engines that combine more power, more strength and endurance, with less weight and space requirements. An ideal combination for marine service.

Ideal, too, for many other power needs—perhaps yours.



American Locomotive

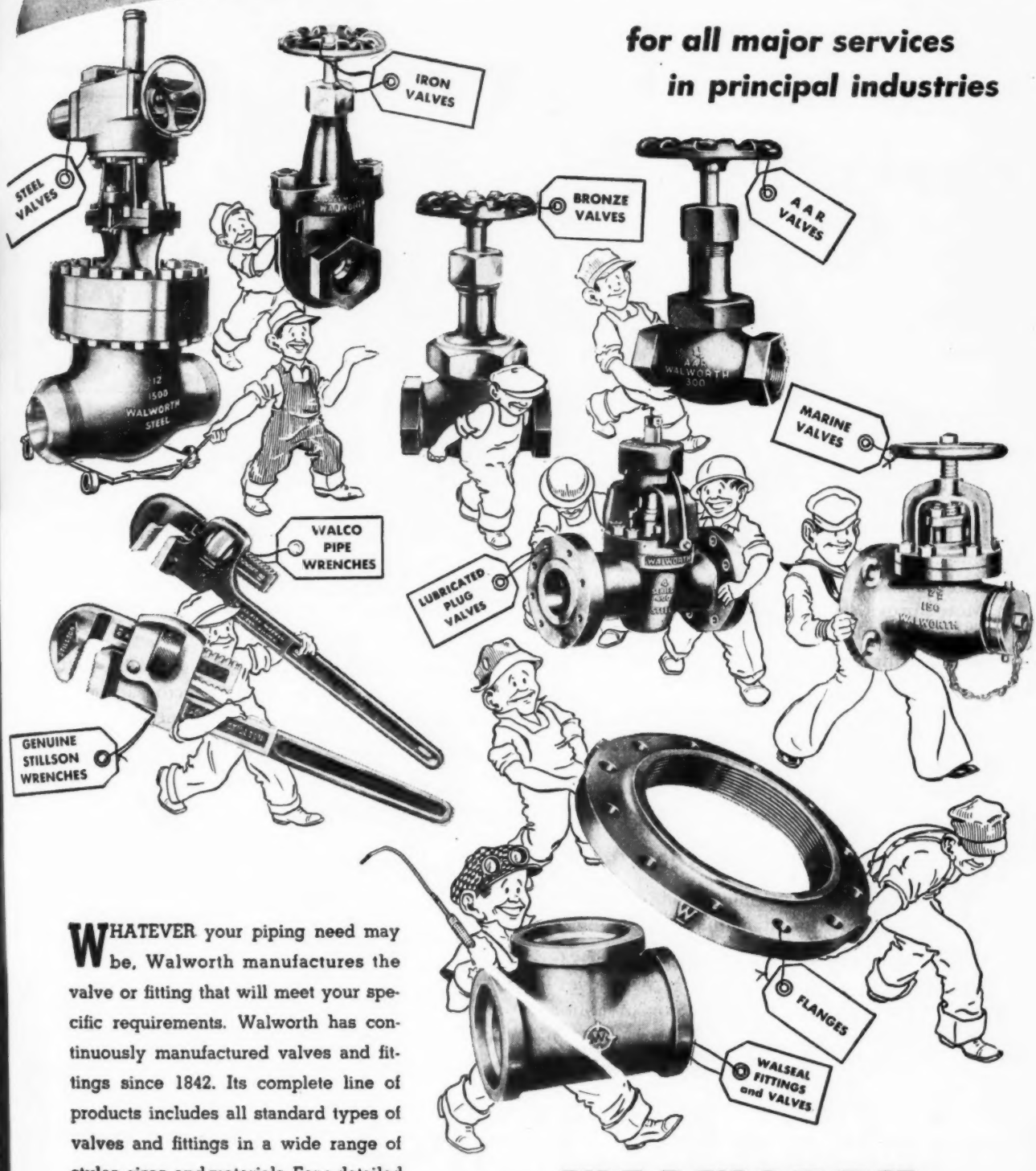
ALCO DIESEL ENGINES

For Universal Application

30 Church Street, New York 8, N.Y.

WALWORTH VALVES and FITTINGS

for all major services in principal industries



WHATEVER your piping need may be, Walworth manufactures the valve or fitting that will meet your specific requirements. Walworth has continuously manufactured valves and fittings since 1842. Its complete line of products includes all standard types of valves and fittings in a wide range of styles, sizes, and materials. For a detailed description of Walworth products, write on your company letterhead for a free copy of Walworth Catalog 42.

12 AWARDS TO 4 PLANTS

WALWORTH
valves AND fittings
60 East 42d Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Versatile

in its application

...this

Fairbanks-Morse Motor maintains its protective features in any position!

The reversible frame of this Fairbanks-Morse Motor provides for mounting the conduit box on either side. The lead-in can be from top or bottom. The bearing arms can be mounted in any one of four positions, 90 degrees apart. Thus, the motor may be installed in any convenient place—in any position, and still retain its protective features.

Other features listed below assure low-cost operation, greater dependability, and longer life. Yes, this is the motor of tomorrow, ready for you today.

OTHER PLUS FEATURES

Protected Frame—Dripping liquids and falling particles excluded in any mounting position.

Crossflow Ventilation—Another exclusive feature in frames 224 to 365 inclusive. Air moves in both directions, providing a motor of uniform temperature. No hot spots.

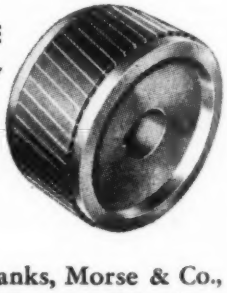
Recessed Conduit Box—An innovation for neat installations. Choice of conventional box or frame recess with cover flush with frame.

Balanced Characteristics—Motor rated 40° C., with high efficiency and power factor, and excellent starting and accelerating torques.

Ball Bearings—Sealed in and protected.

AND THE EXCLUSIVE

Copperspun ROTOR



Centrifugally Cast in One Piece —*and of Copper!*

Write for information, Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

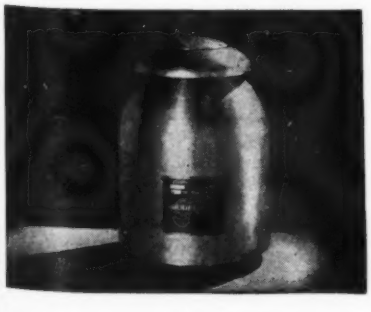
Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scale
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipme

We know the answer to this one . . .

If sometimes tenants complain about not enough heat . . . If other times they're annoyed at too much heat . . . If your fuel bill has shown a decided increase . . . there's only one answer: Your heating system needs *control.*

A Webster automatically-controlled Steam Heating System will assure even heat in every room, regardless of exposure or outside temperature. No overheating . . . No underheating . . . No costly waste of rationed fuel.

In the Webster Moderator System, there are just four control elements—an Outdoor Thermostat, a Main Steam Control Valve, a Manual Variator and a Pressure Control Cabinet. These controls are an integral part of the Webster System — assuring the highest expression of comfort and economy in modern steam heating.



The Webster Outdoor Thermostat automatically changes heating rate when outdoor temperature changes.

More Heat with Less Fuel

Actual surveys made by Webster Engineers show that seven out of ten large buildings in America (many less than ten years old) can get up to 33 per cent more heat out of the fuel consumed.

We'll let you be the judge . . . Send for our free booklet "Performance Facts", and read case studies of 268 modern steam heating installations in commercial and institutional buildings. Shows savings in dollars and cents. Can we help you? Address Dept. P-6.

WARREN WEBSTER & COMPANY, Camden, N. J.
Pioneers of the Vacuum System of Steam Heating : : Est. 1888
Representatives in principal U. S. Cities : : Darling Bros., Ltd., Montreal, Canada

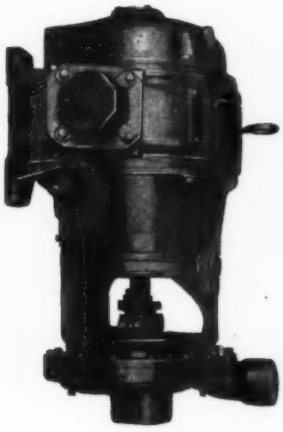
Fuel-Saving Starts With CONTROL

AUTOMATIC Webster Steam Heating

Which side is UP?

Any side is up . . . when it's a Gardner-Denver Close-Coupled Centrifugal Pump. For this versatile pumping unit can be installed anywhere . . . either horizontally or vertically . . . on floor, wall or ceiling.

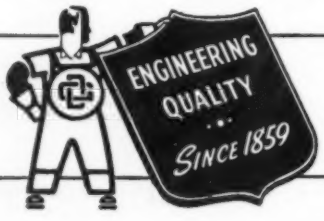
Pump and motor are combined into a single efficient unit, ready for installation . . . a masterpiece of compact design. And regardless of position, they operate economically and effectively. For convenience of installation, discharge nozzles can be turned in any one of eight different positions.



For complete information, write for descriptive bulletin.
Gardner-Denver Company, Quincy, Illinois.

OTHER PUMPING ADVANTAGES

1. **Water passages and impeller blades are carefully proportioned for efficient operation.**
2. **Vital parts cast in GarDurloy for greater strength.**
3. **Splash-proof, explosion-proof motor available if desired.**
4. **Capacities range from 30 to 1200 gallons per minute.**



GARDNER-DENVER

Keeping Navy searchlight reflectors spotlessly clean is an unending job. The HAYNES STELLITE alloy, from which many reflectors are made, is so hard that constant cleaning and polishing will not mar its surface.

LIGHT ON THE RISING SUN

NCLE SAM'S NAVY has the most efficient searchlights n the Seven Seas. They are so powerful that one of nem measuring 24 inches across can shoot a beam of ght through 23 miles of inky darkness.

The reflectors of these searchlights are made of an alloy rfected and produced by HAYNES STELLITE COMPANY.

The Navy is using HAYNES STELLITE alloy for several asons. It will not shatter from shock of gunfire. It has gh resistance to corrosion by salt air, salt spray, powder nd sulfur fumes. It withstands the terrific heat of the c light—and hot particles of copper and carbon from e electrodes do not cause it to pit and lose its reflectivity. Searchlight reflectors are indicative of the many applications to which HAYNES STELLITE alloys — with their unique combinations of properties — can bring more efficient performance.

•

HAYNES STELLITE alloys have long been used for scientific mirrors, surgical and dental instruments and other equipment requiring great resistance to corrosion, wear and heat. Unending research is constantly adding to the variety of these alloys. They can be produced in many exacting shapes—in quantity—and delivered ready for assembly without further finishing.

A booklet describing the properties of Haynes Stellite alloys is available on request.

BUY UNITED STATES WAR BONDS AND STAMPS

HAYNES STELLITE TRADE-MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

General Office and Works UCC Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa

ARMY E NAVY

ABRASION- AND CORROSION-RESISTANT ALLOYS

"HAYNES STELLITE" is a registered trade-mark of Haynes Stellite Company.

Every Watrous Flush Valve has this simple Water-Saver Adjustment

. . . AND IT MEANS EXTRA SAVINGS TO WATROUS OWNERS

Flush valves save water. That is one of the big reasons why they are so widely used today.

Some flush valves save a great deal more water than others because they can be readily adjusted to the actual needs of the fixture on which they are installed.

Fixtures vary in their water requirements—frequently as much as one gallon or more per flush can be saved by proper adjustment. In a building with 200 flush valves this saving could amount to 1,168,000 gallons annually. Water savings like this mean appreciably lower water bills, lower pumping costs. Judge the savings for your buildings from table below.

When you specify Watrous Flush Valves, you make it possible to obtain maximum water savings on *every* fixture—because every Watrous Flush Valve, in both diaphragm and piston types, is equipped with a Water-Saver Adjustment.

This simple screw driver adjustment requires only a few seconds—there is no need to take the valve apart, or even shut off the water. It assures greater water savings to Watrous owners, and is one of the reasons why the selection of Watrous Flush Valves is a source of constant satisfaction over the years to everyone concerned.

Estimated annual savings of water obtainable through proper regulation of flush valve to actual water needs of the fixture

	Building with 100 Flush Valves	Building with 500 Flush Valves	Project with 1000 Flush Valves
When average of ½ gal. saved per flush	292,000 gallons	1,460,000 gallons	2,920,000 gallons
When average of 1 gal. saved per flush	584,000 gallons	2,920,000 gallons	5,840,000 gallons

THE IMPERIAL BRASS MANUFACTURING COMPANY
514 South Racine Ave., Chicago 7, Illinois

. . . another Watrous point of superiority

• Watrous Majestic Flush Valve being adjusted. Simply unscrew cap nut and turn adjusting screw to increase or decrease length of flush.

For complete information on Watrous Flush Valves, write for Catalog No. 448-A. Also ask for Bulletin No. 477 giving a summary of "Architects' Views on Flush Valve Applications."

THEY PAY FOR THEMSELVES IN THE WATER THEY SAVE

Watrous Flush Valves

The air that passes through an Air-Maze filter is really clean . . . freed from the dirt, dust, grit and foreign particles that wear out equipment, impair health, and cause discomfort and costly damage.

The protection that clean air affords has been a contribution of Air-Maze engineers and manufacturers for 20 years. The effectiveness of their job is found in the successful installations in thousands of buildings, hotels and factories . . . in the range canopies in restaurants, ships and hospitals everywhere . . . and on engines and compressors in all types of service.

If you have a problem involving air, ask your nearby Air-Maze representative or write us direct for Catalog No. AGC-144.

AIR-MAZE CORP. • CLEVELAND 5, OHIO

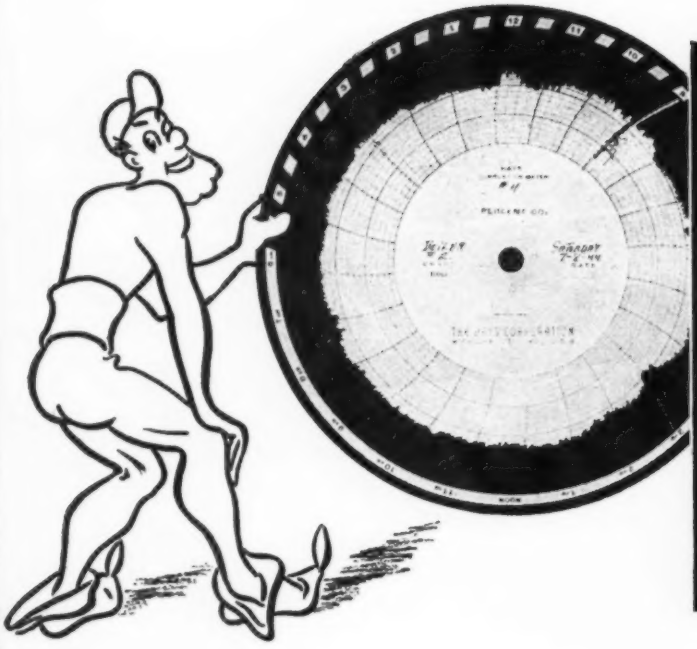
Representatives in principal cities. In Canada: Williams and Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros. Ltd., Vancouver, B. C.

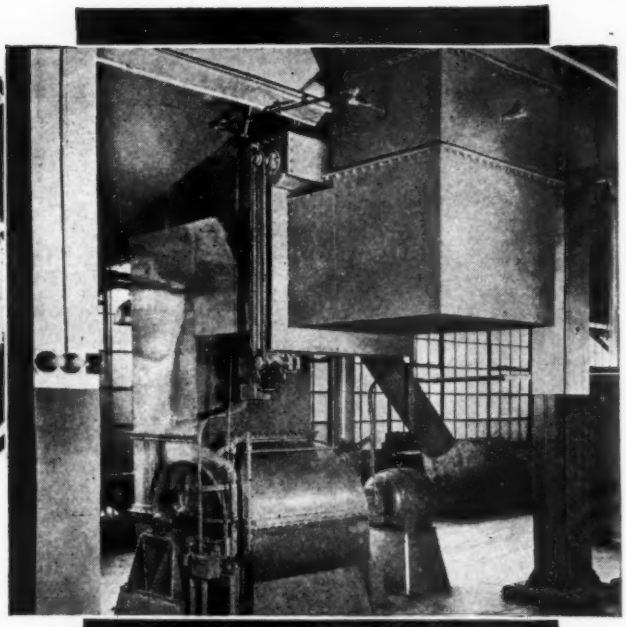
IF IT USES AIR . . . USE

AIR-MAZE

ENGINEERED AIR FILTRATION

• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers • Exhaust spark arresters • Gear case, crankcase and tank vent breathers • Oil-separators for engine crankcases • Full-flow type cleanable oil filters





10-TO-1 CONTROL RANGE!

Summer Load	(*Auxiliaries—Compressors*)	**7,500 lbs. per hr.**
Turbine Testing	(*600 psi—periodic*)	**30,000 lbs. per hr.**
Heating	(*3.5 psi*)	**37,500 lbs. per hr.**
	Total	**75,000 lbs. per hr.**

One of two Westinghouse Stoker fired boilers handles this 10-to-1 load range—under Automatic Control. The second boiler is held in reserve—cold. Annual operating efficiency is exceptionally high.

A Heacon Damper is the heart of this control system.

This performance is a tribute to the superior flow characteristics of the Heacon Damper which make it possible.

Write for the booklet on this unique Damper. So different in design, so amazing in performance, yet adaptable to all installations of from 1,000 lbs. to 1,000,000 lbs. per hour capacity.

THERMIX ENGINEERING COMPANY

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

HEACON GIVES CONTROLLED FLOW

1. MORE RELIABLE OPERATION
2. INCREASED CAPACITY
3. REDUCED MAINTENANCE
4. GREATER FLEXIBILITY
5. HIGHER EFFICIENCY
6. BETTER REGULATION
7. LOWER BANKING LOSSES
8. QUICKER STARTING
9. SAFER OPERATION
10. CLEARANCE WITHOUT LEAKAGE

HEACON INC

DAMPERS

FIELD PROJECT ENGINEERS:

ATLANTA, GA.
C. E. Johnson & Associate
Bona Allen Bldg.

BOSTON, MASS.
Ames & Holbrook
89 Broad St.

BUFFALO, N. Y.
R. S. Brookman
259 Delaware Ave.

CHARLOTTE, N. C.
T. C. Heyward
1408 Independence Bldg.

CHATTANOOGA, TENN.
Edgar A. Rogers
Chattanooga Bank Bldg.

CHICAGO, ILL.
Engineering Sales Co.
1307 S. Michigan Ave.

CINCINNATI, O.
F. Elliman
Chamber of Com. Bldg.

CLEVELAND, O.
H. W. Kaiser Co
1836 Euclid Ave.

DETROIT, MICH.
Metrol Co.
2970 W. Grand Blvd.

DULUTH, MINN.
A. H. Kennedy
214 First National Bldg.

HOUSTON, TEXAS
J. A. Rossiter Co.
P. O. Box 1095

KANSAS CITY, MO.
F. W. Hay & Co.
2734 Cherry St.

LOS ANGELES, CALIF.
A. W. Anderson
164 S. Central Ave.

MINNEAPOLIS, MINN.
Hoyt A. Sevey
314 South 9th St.

NEW HAVEN, CONN.
Daniel Smerling
P. O. Box 1169

NEW ORLEANS, LA.
Arthur C. Hays
1221-23 Carondelet Bldg.

NEW YORK, N. Y.
Parry Engineering Co.
154 Nassau St.

PHILADELPHIA, PA.
Heacon, Inc. Room 1031
Broad Street Station Bldg

PITTSBURGH, PA.
Herr-Harris Co.
545 William Penn Way

RICHMOND, VA.
Frank Howell Co.
Room 412, American Bldg.

ROCHESTER, N. Y.
Johnston Engineering Co.
31 Gibbs St.

SALT LAKE CITY, UTAH
The Lang Co.
267 W. First South

SAN FRANCISCO, CALIF.
S. Herbert Lanyon
58 Sutter St.

SCHENECTADY, N. Y.
Mr. D. R. Whipple
1550 State St.

SEATTLE, WASH.
Lewis & Watts
Fourth & Cherry Bldg.

WASHINGTON, D. C.
T. W. McGuire Co.
Bond Bldg.

STOP THIS TUBE THINNING AND EROSION

Install JOHN CRANE CONDENSER TUBE PROTECTORS

Design Features

- Resistant to contaminated salt or fresh water.
- Unaffected by temperatures to 275° F.
- Provides a Venturi entrance; reduces turbulence.
- Inner end is thin; fits tightly against tube and streamlines flow.
- Lasts for the life of the tube.
- Made for 5/8" and 3/4" 16-BWG, or 5/8", 3/4", 7/8" and 1" 18-BWG tubes.

Provide an armor for the inlet ends of condenser tubes and you eliminate the most common source of tube failure.

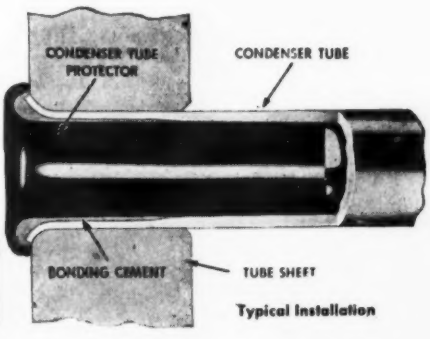
John Crane Condenser Tube Protectors answer the problem of tube end thinning. They act as a protective armor at the entrance section of the tube—*absolutely prevent all erosion and abrasion.*

These Condenser Tube Protectors are molded of a tough, wear-resistant thermo-setting plastic. Installation is easy on old or new tubes; simply slip the Tube Protector into place, in most cases without removal of waterbox head.

Service Tests on many types of Marine and Stationary Heat Exchangers prove that John Crane Condenser Tube Protectors greatly lengthen tube life, saving critical metal.

Power and Marine Engineers: Get the complete facts on the John Crane Condenser Tube Protector.

SEND FOR THIS BULLETIN



Typical Installation

CRANE PACKING COMPANY

1811 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

"These 3 rods sure help me do a swell welding job . . . "

AIRCO NO. 27
LOW FUMING BRONZE ROD
an excellent type of low-fuming bronze rod, with minimum release of obnoxious and detrimental fumes. High tensile strength; good tinning qualities on steel (on cast iron paint surface with Airco Hi-Bond Flux).

AIRCO NO. 1
ALLOY STEEL ROD
specifically designed for oxy-acetylene welding of steels comparable to Grade A and B pipe analysis . . . meets all A.S.A. Pressure Piping Code qualifications.

AIRCO NO. 7
MILD STEEL ROD
for highest quality general welding of steel plate, sheet, structural steel and piping.

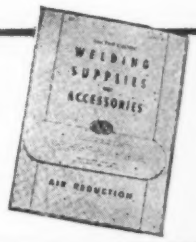
WELDERS do find these three rods easier to work. Their smooth flowing qualities, uniformity and ductility enable them to do a better job . . . faster — every time.

This is true of any Airco rod, flux or other supply item. In fact, for more than a quarter century, welding operators and burners have found Airco products to be "tops in the field" for all oxyacetylene welding and cutting jobs.

And Airco's offices — conveniently located in all principal industrial centers—can make delivery from stock. Call your nearby Airco office today.

Save Buying Time—

Send for your FREE copy of Airco's illustrated "Welding Supplies Price List". It gives further details on Airco's comprehensive line of gas welding supplies. Address your nearest office or write to Dept. P at the New York office.

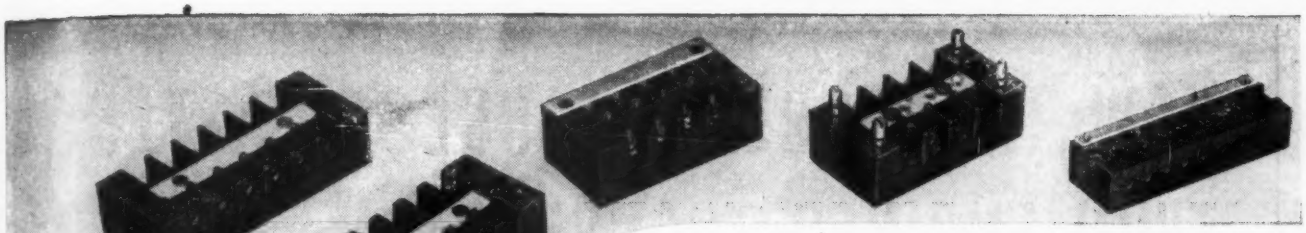


AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.
In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON 1, TEXAS
Offices in All Principal Cities

AIRCO

Everything for gas welding and cutting



NEW *Catalog* AVAILABLE ON BURKE TERMINAL BLOCKS

If your problem is control circuit design, layout, or installation, you will want this new informative bulletin on Burke Molded Bakelite Terminal Blocks. The Bulletin contains actual size cross sectional illustrations showing detail construction features, with dimension and prices on all types and sizes.

Burke Terminal Blocks provide a simple method of identifying, sectionalizing and terminating intricate control circuit wiring—a few of the typical applications are listed below. Prompt deliveries are being made.

Write for your copy of booklet TB-3

BURKE ELECTRIC COMPANY • 256 W. 12th STREET • ERIE, PA.

» A FEW *Typical* USES

Electronic Control Systems • Radar Equipment • Radio Receiving and Transmitting Sets • Telephone and Telegraph Switchboards • Load Dispatching Signal Systems • Fire and Police Signal Systems • Traffic Signal Systems Machine Tool Control • Voltage Regulator Equipment Switchboards of all kinds • Automatic Welding Control Induction Heating Control

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

HOW THE WORLD'S LARGEST, FASTEST, TWIN-ENGINED TRANSPORT *Counts its Calories*

Bowser XACTO Meters Precision-Check Fuel Flow and Consumption for Today's Great Lifeliner, Tomorrow's Great Airliner

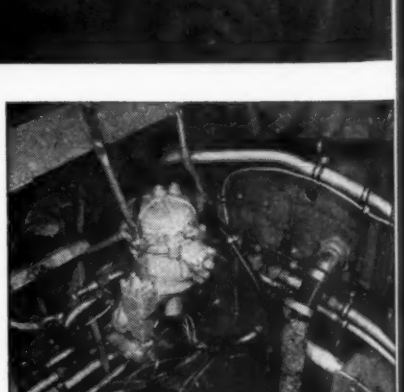
They call it the Burma Road of the Air because three-quarters of all the vital war supplies, flown over the towering Himalayas into China, have been transported in the Curtiss Commando.

Little wonder that this mighty twin-engined transport is known as today's great lifeliner, tomorrow's great airliner.

And less wonder that Curtiss-Wright selected Bowser Xacto Meters for testing fuel flow and consumption, gross weights, and center of gravity locations for stability and control for the Curtiss Commando.

Carrying vital cargos of war-winning materiel and personnel over thousands of air miles demands that those vital calculations be measured with hairline accuracy because lives . . . American lives and thousands of them . . . hang in that exacting balance.

Your liquid control problems may not involve lives or battles. But if they do involve costs, production and profits . . . if they call for precision-measurement and control . . . Bowser can make a real contribution. In the power industry, Bowser Liquid Control—turbine oil conditioners, filters and force feed lubricators, for instance—are doing the job better and for less. Bowser Filters, working under severe power plant operating conditions, have demonstrated their ability to keep oil clean and efficient much longer. For details write BOWSER, INC., Dept. 2-F, Fort Wayne 2, Ind.



The Bowser XACTO Meter Installation on the Curtiss Commando

BOWSER

SINCE 1885

Not only has Bowser's war production earned the Army-Navy E . . . Bowser equipment has helped earn it for scores of other companies.

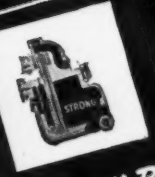
THE NAME THAT MEANS EXACT CONTROL OF LIQUIDS

PROBLEM: To recover heat by reflashing steam from high pressure condensate into low pressure system, SAVING LATENT HEAT

125# SYSTEM → WHAT GOES HERE? ← 15# SYSTEM

Here's STRONG'S Suggestion:

125# SYSTEM → TRAP → 15# SYSTEM → TRAP → 0#



LATENT HEAT AT 15# = 945 BTU

EXAMPLE: Steam @ 125# (350°F) = 324 BTU'S in liquid
Steam @ 15# (250°F) = 218 BTU'S in liquid
106 BTU'S excess

$\frac{106}{945} = .112 + 11.2\%$ flashes into 15# steam

WHAT YOU CAN SAVE

Hi-Press. Condensate per hour	Reflash Steam (11.2%)	SAVINGS Per Hour	Per Day	Per 360 Days
1000 #	112 #	$.045	$1.08	$388.80
2000 #	224 #	.090	2.16	777.60
4000 #	448 #	.180	4.32	1555.20
5000 #	560 #	.225	5.40	1944.00
10000 #	1120 #	.45	10.80	3888.00

(Savings based on steam cost of 40c per 1000 lbs.)

IF YOU'RE LIKE US . . .

You probably get a pain in the neck when someone tells you that changing from Whosis to Whatsits will save you more than you pay in taxes.

Sure, good equipment can pay its way. And installing the right type shows up the waste caused by using the wrong type.

But real savings grow out of ideas. That's where Strong comes in on steam. With a *complete* line of traps and other specialties, Strong engineers can apply a lot of proved ideas to your installations —and not have to compromise for lack of the right kind of unit to do the best possible job.

Try sending your drainage problems to:

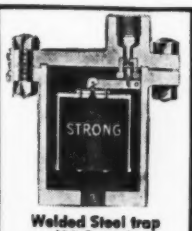
STRONG, CARLISLE & HAMMOND CO.,
Cleveland 13, Ohio

REG. TRADE MARK

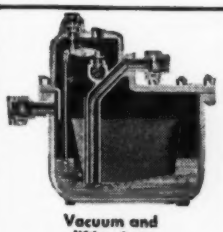
OTHER ANUM-METL Reg. Trade Mark

STRONG

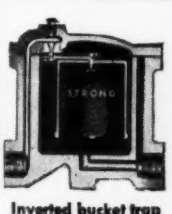
STEAM SPECIALTIES



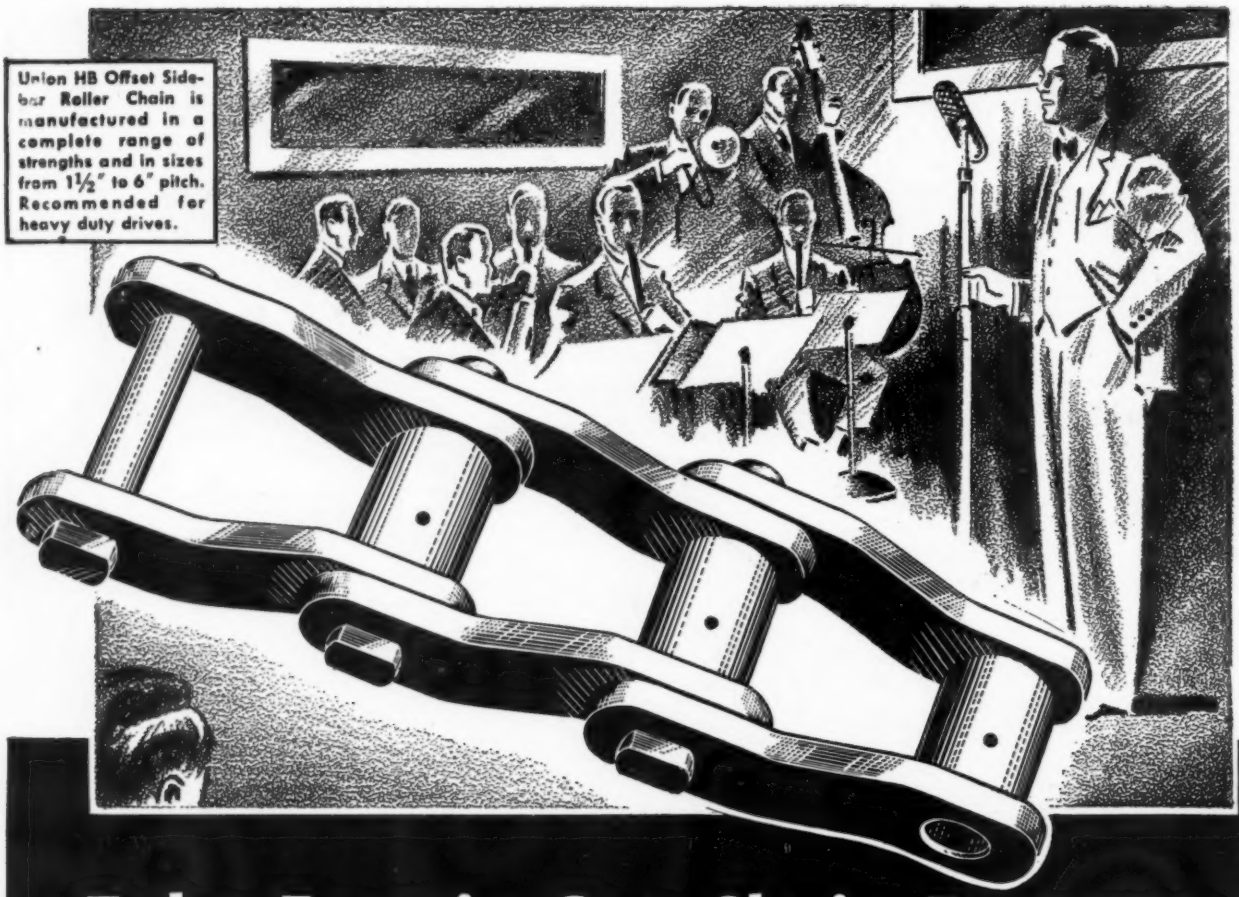
Welded Steel trap (90 Series)



Vacuum and lifting trap



Inverted bucket trap (70 Series)



Union HB Offset Sidebar Roller Chain is manufactured in a complete range of strengths and in sizes from 1½" to 6" pitch. Recommended for heavy duty drives.

Take Part in Our Chain Program

☆ It may be possible for you to be our star. For, our Chain Program is a campaign to acquaint more chain buyers with Union Chains and the stars of such a program are, of course, our new customers.

So if you haven't used Union Chains, call us in on your next requirement. We'll do our best to make it your most satisfactory chain contact. Our confidence is based on our reputation as chain specialists, earned because we confine ourselves to the manufacture of a complete line of steel chains, sprockets and flexible couplings. Then, too, we do all we can to be sure that our chain is used properly and that adds years of life. Whose life? Why the life of the chain and yours, too.

The Union Chain and Manufacturing Company . . . Sandusky, Ohio, U. S. A.

Union Chains for Every Application

Drive and Conveying Chains and Sprockets
- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets
- All manufacturer's standard, size ⅛ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets
- All sizes ⅜ in. to 1½ in. pitch

★

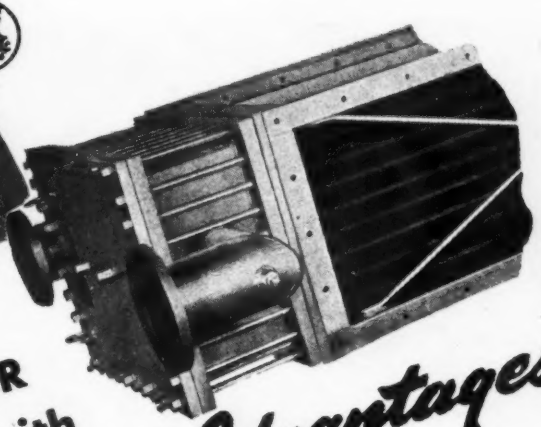
Flexible Couplings
- Roller chain type
- Silent chain type

Catalog A-2 covers Drive and Conveying Chain. B-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

ARMY ★ (E) NAVY

UNION CHAINS

K-FIN



the GENERATOR AIR COOLER with 9 Important Advantages

1 **LASTING TIGHTNESS** . . . assured by patented Multigroove roller expanded packless tube joints at both ends

2 **LOW INSTALLATION COST** . . . permitted by compact design, requiring only simple piping and duct work

3 **FREE EXPANSION AND CONTRACTION** . . . permitted by the flexible tubing insert between shell frame and floating tube sheet

4 **MAXIMUM HEAT-ABSORBING SURFACE** . . . provided by the patented helical K-Fin heat transfer surface which greatly increases the exterior area of the tubes

5 **CONVENIENT ACCESS** . . . permitted by readily removable cover plates at each end for inspection and cleaning.

6 **CONVENIENT TUBE REPLACEMENT** . . . individual tubes can be withdrawn without disturbing adjacent tubes

7 **RIGID CONSTRUCTION** . . . support plates hold tubes in correct position throughout their entire length, and design eliminates tube vibration

8 **LOW AIR PRESSURE LOSSES** . . . provided by generous tube spacing

9 **EFFICIENT WATER DISTRIBUTION** . . . assured by simple multi-pass water heads which also provide efficient use of allowable water pressure drop

Write for Bulletin 1219 describing these units in detail.

ONE OF A SERIES OF ADVERTISEMENTS DESCRIBING THE MANY TYPES OF G-R HEAT TRANSFER APPARATUS

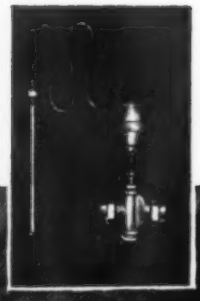
G-R BUILDS ALL THESE UNITS FOR HEAT TRANSFER SERVICE . . .

Evaporators
Stage Heaters
Gas Coolers
Drain Coolers
Aftercoolers
Air Preheaters
Fuel Oil Heaters
Jacket Water Coolers
Process Heat Exchangers
Transformer Oil Coolers
Generator Air Coolers
Lubricating Oil Coolers
Storage Tank Oil Heaters

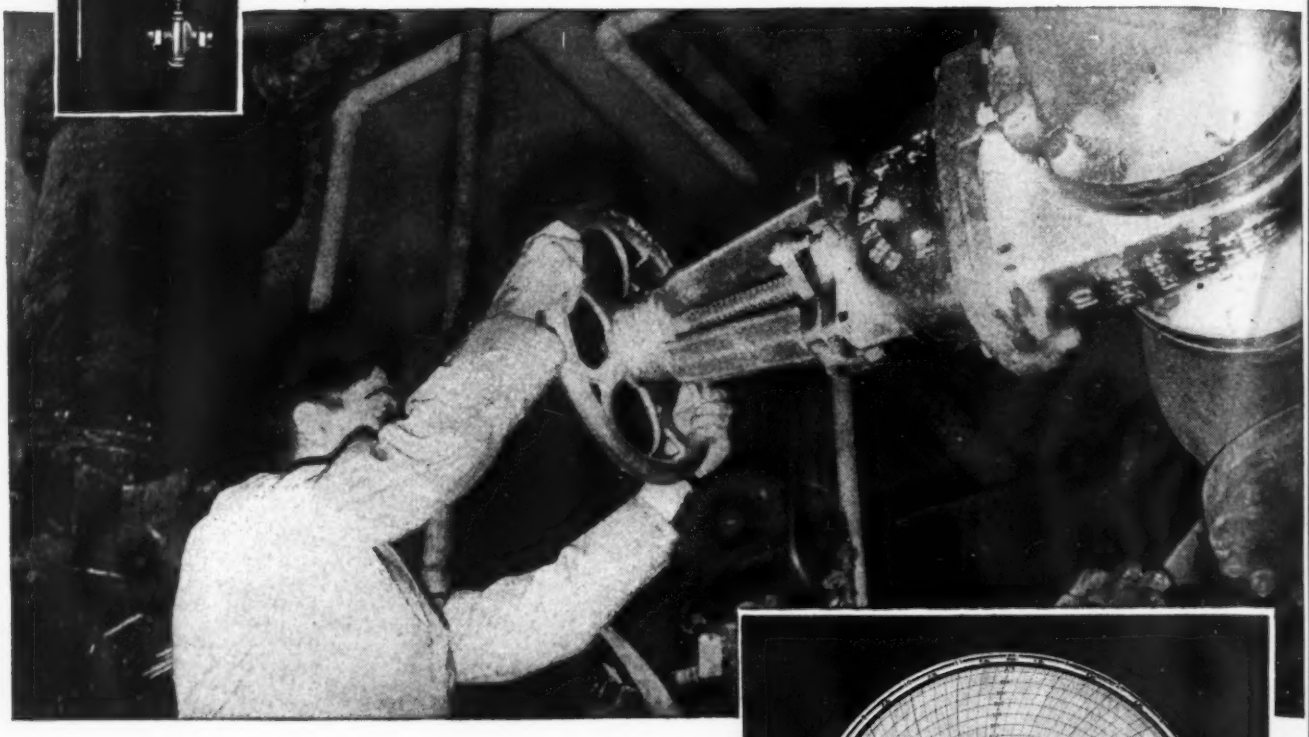
THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus



DOES MAN'S WORK BETTER



A familiar sight?

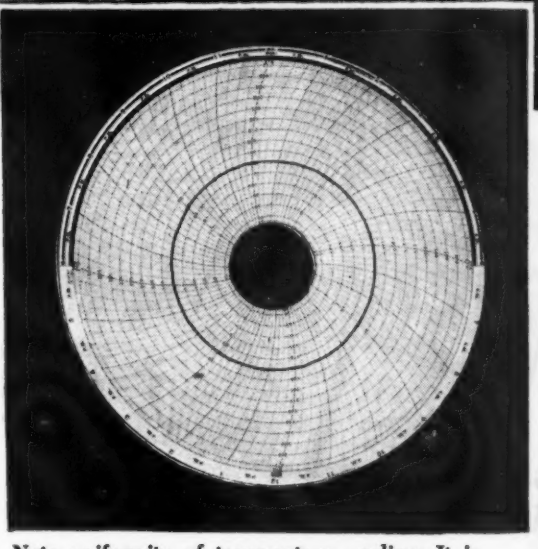
Yes, indeed. Here again manpower is being wasted at a job instruments do better *automatically.*

In thousands of processing plants, Fulton Sylphon Temperature Regulators open and close valves with absolute accuracy and precision at all hours of day and night . . . assuring constant uniformity of temperature, saving fuel, helping improve product quality.

The temperatures controlled range from far below zero to 480° Fahrenheit.

As for the instruments themselves, Fulton Sylphon Regulators are backed by more than 40 years' experience . . . meticulously designed and constructed to give long, trouble-free service . . .

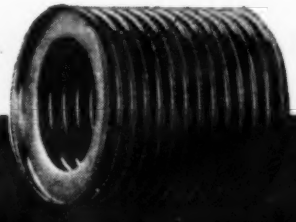
If you have a problem which involves temperature control, write for Bulletin LS-20. It contains much valuable information.



Note uniformity of temperature reading. It is characteristic of all systems where Fulton Sylphon Regulators are employed to control temperatures within close limits.

NEW MOVIE . . . "The Story of a Bellows" shows clearly the operation of various types of temperature regulators. Available to interested executives and organizations.

FULTON SYLPHON

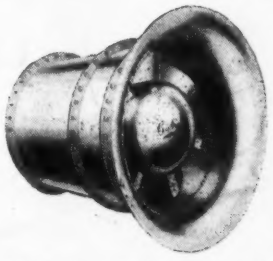


CLEARING THE DUCTS FOR ACTION

When one of our new super-battleships like the 45,000 ton Iowa throws its "Sunday punch" at the enemy, it must have plenty of air. Even when riding quietly at anchor, fresh air in unfailing supply is the breath of life to fighting men and machinery alike, everywhere in its vast interior.

To keep ventilating ducts "breathing" efficiently in the heat of battle, the Navy had to be *tough* in its specifications for every last detail of their design and construction. Star's assignment was building motors to turn the fans. As it has done so often before, Star was able to meet or exceed the specifications for these motors, and deliver *on time!*

What Star has done on this and other jobs for the U. S. Navy . . . the World's Toughest Customer . . . it can do for you. While the Navy never endorses any product, the fact that Star has long been a Navy supplier should tell you what you want to know about Star Motor performance. If a standard Star Motor (⅛ to 200 H.P.) does not meet your requirements, tell us your special needs, and we'll build one that does! Star Electric Motor Company, Bloomfield, N. J.



Satisfying the World's Toughest Customer

This axial flow ventilating fan, used on all six of the new 45,000 ton *Iowa*-class, and on four of the 35,000 ton *North Carolina*-class battleships, is made by Buffalo Forge Company.

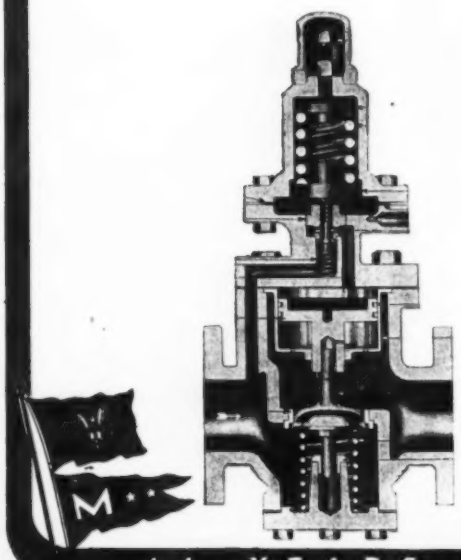
Engineering a motor to power this fan typifies the tough Navy problems Star has solved so many times. Since the fan had to be installed directly in the ventilating duct, an exceedingly compact motor was a "must". Star engineers reduced frame size without reducing power. They used special stator design and ball bearing housings to achieve maximum heat dissipation while operating in a high ambient temperature of 149° F. Moreover, the motor was built to meet all hi-shock conditions.

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

How to make a SISSY OF YOUR TOUGHEST STEAM REDUCTION PROBLEM

Get acquainted with K & M Type 479 . . . the internal pilot operated pressure regulating and reducing valve that is a veteran of many a difficult installation. You'll get *very* close constant control at high and low pressures, regardless of inlet variations. You'll get freedom from chattering and excessive wire drawing on low loads. You'll get tight closure in dead-end service. Type 479 is built for initial pressures to 600 lbs.; reduced pressures from 2 lbs. to 80% of inlet. There are 66 years of steam control experience built into Type 479. You can count on getting long years of cost-saving performance out of it. Furnished with bodies of standard or extra heavy semi-steel or cast steel; trim of bronze, monel or 18-8 stainless steel; sizes 2" to 10", flanged connections.



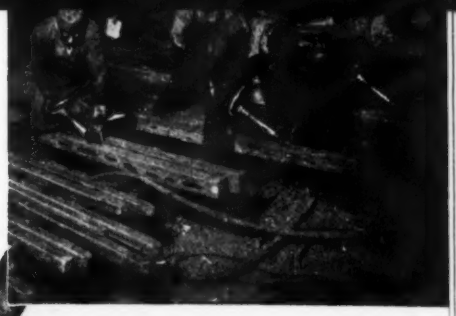
Our Engineering Department is ready to work with you . . . without obligation . . . without delay.

KIELEY & MUELLER, INC.

MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS SINCE 1879

2001—43rd St., North Bergen, N. J.

66 YEARS OF CONTROL PROGRESS

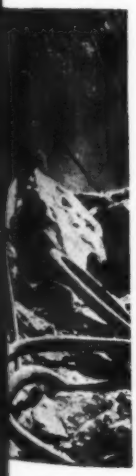


10 ADVANTAGES

1. Extreme flexibility—easy to handle
2. Resists kinking
3. Light in weight
4. Practically inseparable cover and plies—balanced homogeneous construction
5. Withstands high pressures and surges with wide margin of safety
6. Uniform inside diameter
7. Less elongation and expansion
8. Less fatigue to operator
9. More production
10. Lower ultimate cost

Condor HOMO-FLEX HOSE

contributes to greater production and longer hose life



Every one of these 10 advantages contribute to the multiple economies of long service life; resistance to high working pressures and surges; easy handling with less operator fatigue; toughness to withstand wear, abrasion and kinking.

Still another **MANHATTAN** advantage—Turnate Vulcanization—imparts added strength to Homo-Flex Hose. This process gives uniform inside and outside diameters, uniform texture and resiliency to the **MANHATTAN** Strength Members and the **FLEXLASTICS** tube and cover.

Condor Homo-Flex Hose is or will be available in types for the following services: Air, Water, Steam Pressing Iron, Orchard Spray, High Pressure Mine Spray, High Pressure Oil Spray. Write for Bulletin No. 6879.

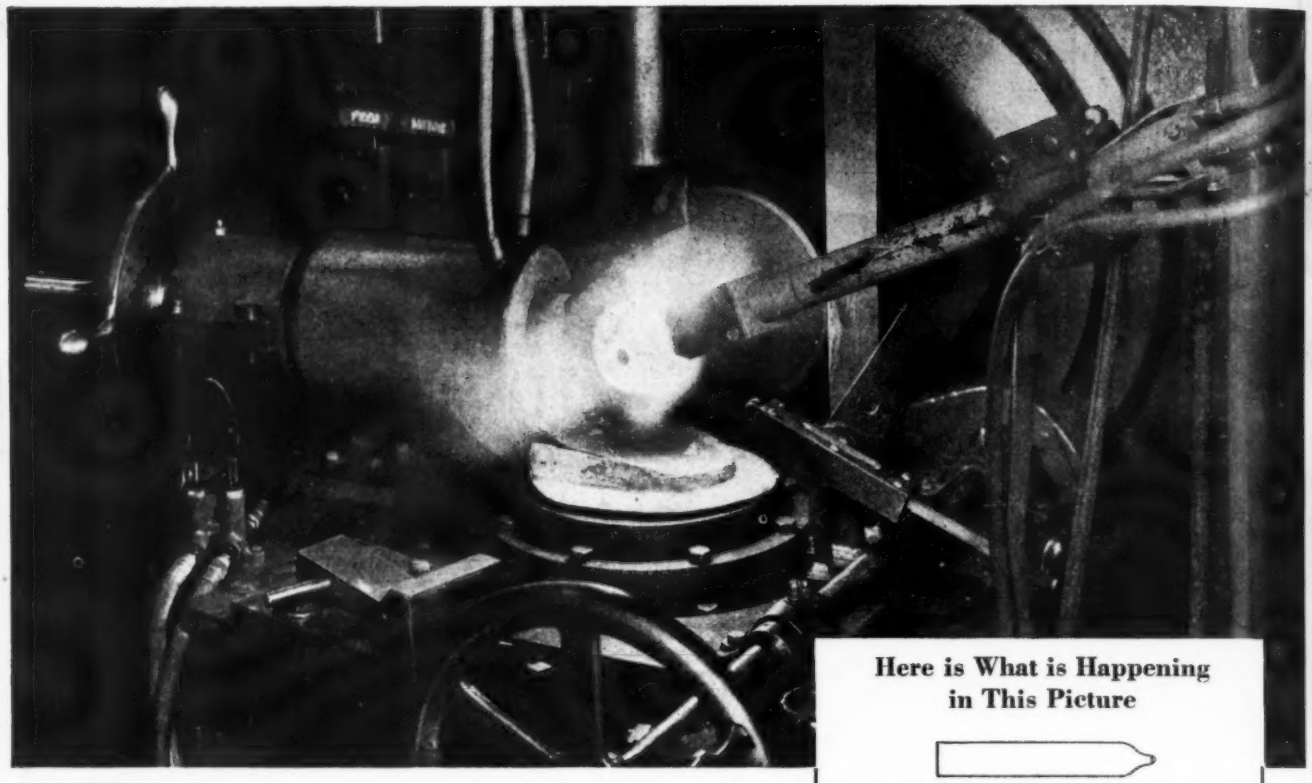
The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.

THE MANHATTAN RUBBER MFG. DIVISION

OF RAYBESTOS-MANHATTAN, INC.

Executive Offices and Factories PASSAIC, NEW JERSEY

FLAME-SPINNING SIMPLIFIES PRODUCTION *Of Tubular Parts And Containers*

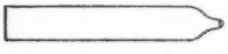


• Oxy-acetylene flame-spinning has made the end-forming of tubular products a simple, uninterrupted operation. It is a fast, inexpensive method for partially closing the ends of tubing, or for making a complete closure like this or for reducing diameters at any point like this

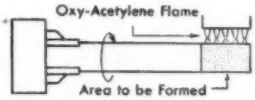
Ask a Linde representative for further information or write for a copy of the folder, "Flame Spinning Process," Form 5915.

The intense, easily controlled heat of the oxy-acetylene flame also is a simple means of quickly softening metal for bending, straightening, and other forming operations where the application of heat to a localized area is important.

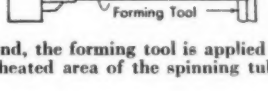
Here is What is Happening in This Picture



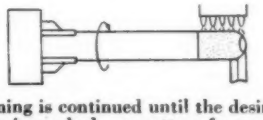
A part shaped like this is being produced from stock tubing



First, the tubing is fastened in a machine and spun rapidly while the oxy-acetylene flame heats the area to be formed.



Second, the forming tool is applied to the heated area of the spinning tube.



Forming is continued until the desired shape is reached—a matter of seconds.

Buy United States War Bonds and Stamps

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

The Linde Air Products Company

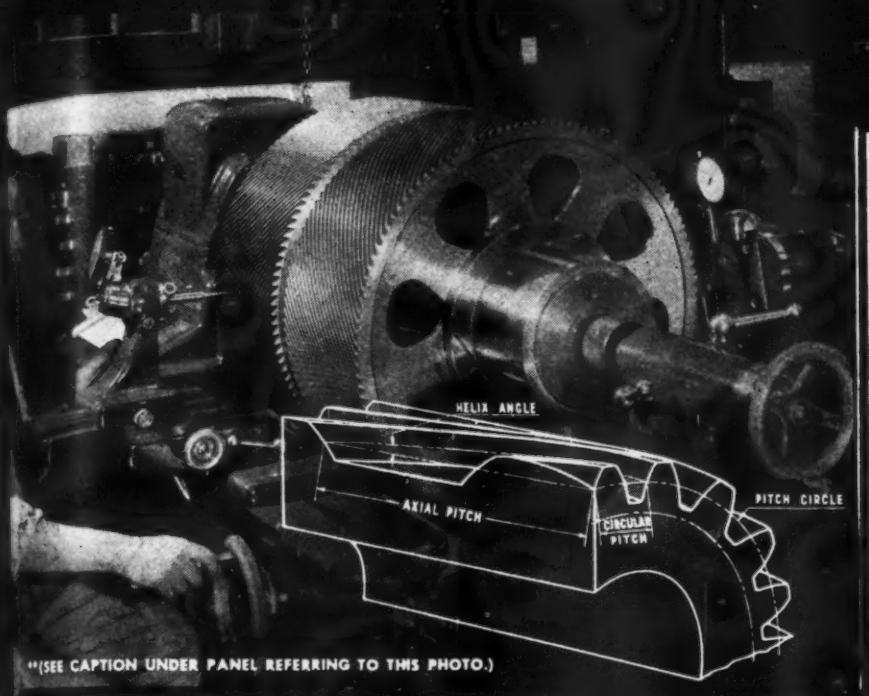
Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

LINDE OXYGEN . . . PREST-O-LITE ACETYLENE . . . UNION CARBIDE
OXWELD, PUROX, PREST-O-WELD, UNIONMELT APPARATUS
OXWELD AND UNIONMELT SUPPLIES

The words "Linde," "Oxweld," "Prest-O-Lite," "Prest-O-Weld," "Purox," "Union," and "Unionmelt" are trade-marks of Union Carbide and Carbon Corporation or its Units.



"(SEE CAPTION UNDER PANEL REFERRING TO THIS PHOTO.)

Studious Inquiry

at Falk Antedated "Modern Research" by Over 40 Years!

When plastics from resins and magnesium from sea water were only a gleam in the eye of scientists, Falk research was "a going concern."

It was started forty-nine years ago!

Today, more than ever before, Falk is involved in probing structural mysteries through metallurgy and chemical analysis; in tearing apart the "fibers" of metals by mechanical testing; and in delving into the technologies of mechanical power transmission.

All of this studious inquiry was established Falk practice before the phrase "Modern Research" was born!

It is understandable why Falk is a good name in industry.

For by this studious inquiry, Falk has contributed much to the art of its own industry, just as it has to its customers, its community, and its employes, by the maintenance of and adherence to a basically sound, intelligent, and equitable business policy.

It always pays to consult Falk!

* FALK CONTRIBUTIONS

1896 ... The first Falk research was initiated 49 years ago in a Chemical Laboratory devoted to the testing of "ingredients of materials" used in the manufacture of Falk products.

1900 ... Metallurgical research was made a part of the Chemical Laboratory so that "Falk's foundry work included not only its art but also its science."

1905 ... An old Falk catalog refers to Falk research and describes "our own Chemical and Testing Laboratories which enable us to secure a complete record—microscopic, physical, and chemical—of all material used in our furnaces and of the resultant castings."

1906 ... Harold S. Falk, now President, graduated from the University of Wisconsin, the first student of that school to major in metallurgy, stimulating further interest in the importance of research in the field of metal-working.

1910 ... Falk designed and built its own gear hobbing machine in order to manufacture an improved type of herringbone gear which Falk research had proved feasible.

1927 ... An extensive research program of gear performance and capacities was inaugurated. The findings, later presented in an engineering paper, were subsequently found to possess widespread significance.

1929 ... The first research program on the Falk All-Steel Flexible Coupling was started, resulting in improved performance and longer life.

1934 ... The research on gear performance and capacities, started in 1927, was brought to a conclusion and culminated in the Schmitter Rational Gear Formula, now accepted by the industry as the basis for gear design and rating.

1935 ... Further research on Falk Couplings resulted in a coupling that is unique both from the design and long, trouble-free service standpoint.

1938 ... Research was carried on which led to the famous Falk Marine Reverse Drive used in army cargo boats, tugs, navy barges, and exclusively in LST's.

TODAY ... Gruelling tests in which couplings are being operated under severe misalignment, and gear tests at speed step-ups as high as 30,000 revolutions per minute are now in progress.

* * Falk technicians are never satisfied that they have reached the ultimate. Here, in this photograph, the helical lead of a turbine reduction gear is being checked on a lead checking machine.

THE FALK CORPORATION MILWAUKEE 8 WISCONSIN

For over fifty years precision manufacturers of Speed Reducers ... Motoreducers ... Flexible Couplings ... Herringbone and Single Helical Gears ... Heavy Gear Drives ... Marine Turbine and Diesel Gear Drives and Clutches ... Contract Welding and Machine Work. • District Offices, Representatives, or Distributors in principal cities.

IT ALWAYS PAYS TO CONSULT **FALK** ... A GOOD NAME IN INDUSTRY

Many Armed Servant

The many arms of the FEDERAL organization are the arms of a versatile servant . . . making war goods now and preparing for the new and greater demands of a world at peace.

* * *

For example, FEDERAL INSTRUMENT LANDING AND RADIO RANGE equipment is pioneering new concepts of faster, safer air travel.

FEDERAL'S MEGATHERM dielectric and heat induction units are revolutionizing production processes in the plastics, metal, food, plywood, textile and other industries.

FEDERAL always *has* made better tubes. Today, as the result of continuous scientific development, FEDERAL'S TRANSMITTING, RECTIFYING AND INDUSTRIAL POWER TUBES are proving even more dependable and long lasting.

To fill a vital war need, FEDERAL developed INTELIN ULTRA HIGH FREQUENCY TRANSMISSION LINE — now is the world's largest manufacturer.

FEDERAL'S MARINE RADIO EQUIPMENT, first in serving America's merchant fleet, includes DIRECTION FINDERS, AUTO ALARMS, packaged TRANSMITTING AND RECEIVING UNITS and LIFEBOAT TRANSMITTERS.

Back of every FEDERAL TRANSMITTER are years of engineering and manufacturing experience which assure the ability to produce any type or power of communications equipment from walkie-talkie to 200 K.W. transmitters.

QUARTZ CRYSTALS, precision cut and mass produced at FEDERAL, are performing many secret military jobs.

SELENIUM RECTIFIERS, introduced by FEDERAL, are accepted as standard for converting alternating to direct current. Power equipment and battery chargers, powered by FEDERAL SELENIUM RECTIFIERS, are known for long life, high efficiency and low cost.

* * *

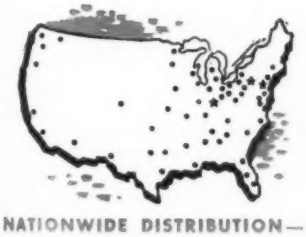
Yes, FEDERAL'S many arms make many things — all to one high standard. Here some of the world's keenest scientific minds combine their talents with three decades of FEDERAL leadership for developing and producing better communications and industrial electronic equipment.

Federal Telephone and Radio Corporation

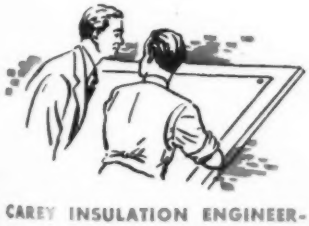
Newark 1, N. J.

An IT&T Associate

"Fugitives" from your power gang?



NATIONWIDE DISTRIBUTION— Warehouse stocks of the broad Carey line provide service regardless of job location.

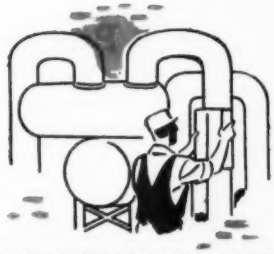


CAREY INSULATION ENGINEERING SERVICE makes available the knowledge and experience of leading authorities.

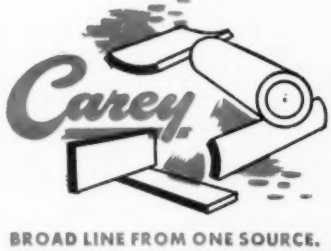
Give a BTU a bare or poorly insulated pipe . . . and he'll "make a break." Multiply his "escape act" millions of times a day and you come to this conclusion: he's *wasting* a lot of fighting fuel you need.

Adequate insulation is the answer. And Carey simplifies that problem by offering you (1) a broad line of types, shapes and forms of insulation *plus* (2) the engineering ability to determine the one best insulation or combination of insulations for your job.

To apply Carey's 50-odd years of Heat Insulation engineering experience to your problem—just write—



TRAINED ERECTION AND SERVICE CREWS "make sure" the job is done right.



BROAD LINE FROM ONE SOURCE. No need to compromise with desired results. You get the right insulation for the job.

THE PHILIP CAREY MANUFACTURING CO.
LOCKLAND, CINCINNATI 15, OHIO

Carey

IN CANADA: THE PHILIP CAREY CO., LTD.
OFFICE AND FACTORY: LENNOXVILLE, P. Q.

Careyduct • Industrial Insulations • Rock Wool Insulation • Asbestos Shingles and Siding • Asphalt Shingles and Roofings
Built-up Roofing • Roof Coatings and Cements • Waterproofing Materials • Asphalt Tile Flooring • Pipeline Felt
Expansion Joint • Asbestos Wallboard and Sheathing • Corrugated Asbestos Roofing and Siding • Miami-Carey Bathroom Cabinets and Accessories

CALOL RPM

STANDARD ENGINEERS NOTEBOOK

VOL. 2-E No. 4

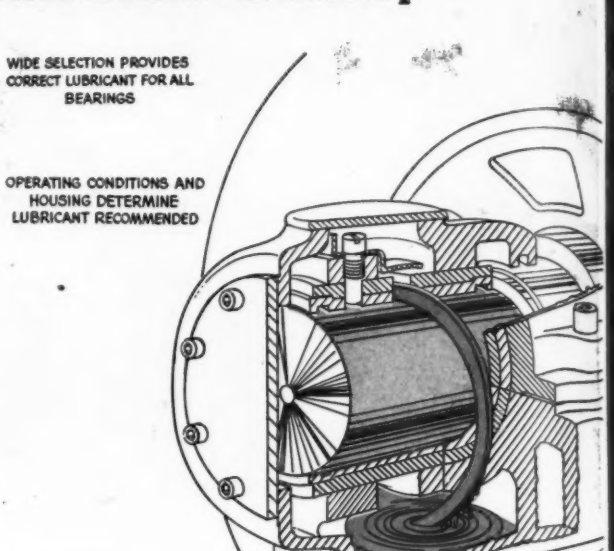
Calol oils maintain electric motor efficiency

Meeting all conditions encountered in the various types of bearings used in electric motors, Calol Oils reduce friction to a maximum degree, carry away heat and minimize the formation of deposits.

For electric motors equipped with ball- and roller-bearings Calol Engine Oil 8 or 10 is recommended when speeds are high, operating conditions normal and housings oil-tight. Calol Turbine Oil 15 or 19 is used when speeds are low or temperatures high and there is a heavy end-thrust; Calol Diesel Engine Oil 65 or Calol Deturbo Oil 60 when bearings operate under extreme pressures and temperatures.

Three recommendations are made for motors equipped with ring-oilers. Calol Engine Oil 8 for low temperature conditions, Calol Engine Oil 10 for normal temperatures and Calol Turbine Oil 15 for high temperatures.

Where wick-oilers are used or oil is applied to waste, the recommendations for ring-oilers apply.


WIDE SELECTION PROVIDES CORRECT LUBRICANT FOR ALL BEARINGS
OPERATING CONDITIONS AND HOUSING DETERMINE LUBRICANT RECOMMENDED
CORRECT VISCOSITY ASSURES FREE FLOW IN ALL TYPE OILERS

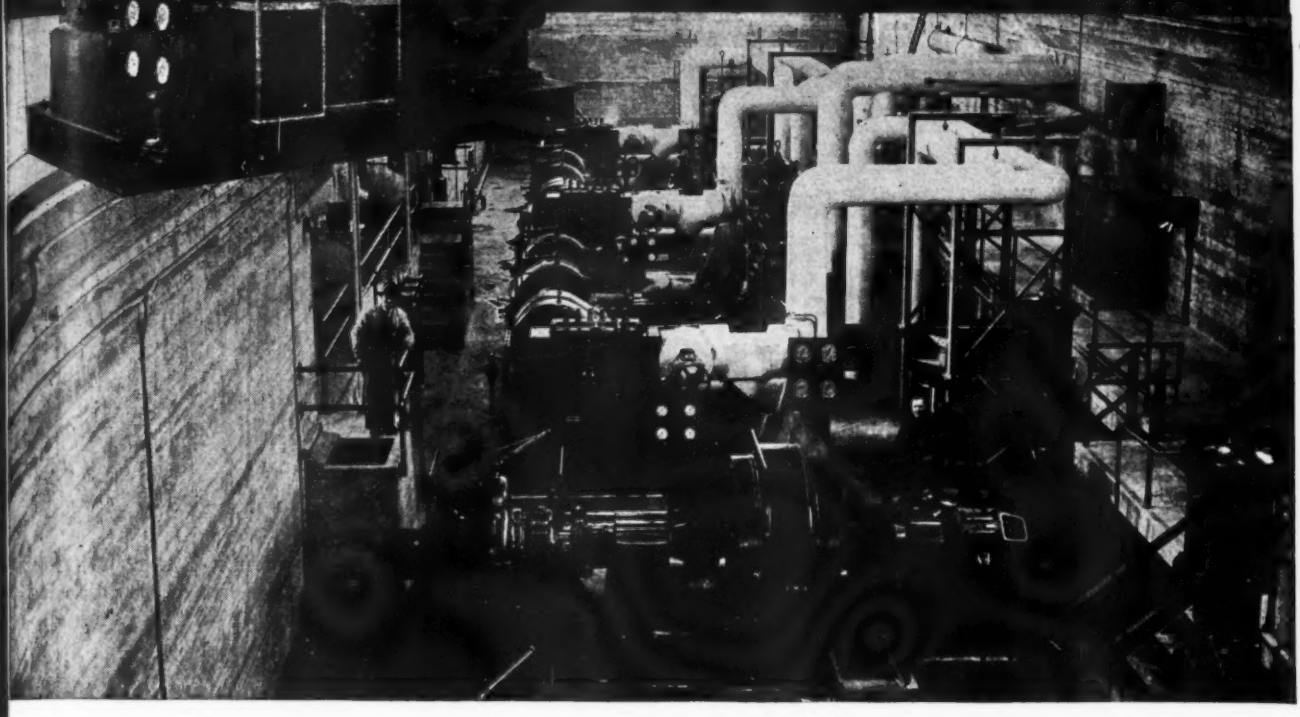
Proper oil solves steam engine lube problems

Steam Engine Types and Operating Conditions	Lubricant	Steam Engine Types and Operating Conditions	Lubricant	Steam Engine Types and Operating Conditions	Lubricant	Steam Engine Types and Operating Conditions	Lubricant
Low pressure, saturated steam where rapid atomization required. Pressures up to 100 lb. gauge.	CALOL CYLINDER OIL—95X (Low vis., compounded)	Marine reciprocating engines without condensers — fresh water easily obtained. Pressures up to 150 lbs. and excessive moisture conditions.	CALOL VALVE OIL—125FX (Med. vis., heavily compounded, filtered)	Saturated or slight super-heat steam with pressures around 150 lbs.—condensate returned to boilers for ice manufacture or heating. Marine reciprocating engines with condensers.	CALOL CYLINDER OIL—160 (Med.-high vis., straight mineral)	Normal wet and moderate super-heat steam. Pressures to 225 lbs. gauge; temperatures to 550° F.	CALOL CYLINDER OIL—155PX (Med.-high vis., compounded 100% Pennsylvania)
Stationaries, donkeys, pumps, units using dry and saturated steam. Pressures to 150 lb. gauge; temperatures to 370° F.	CALOL CYLINDER OIL—130X (Med. vis., compounded)	Condensing-steam, heating and distilled-water-ice plants, etc., where rapid separation from water necessary. Pressures to 160 lb. gauge; temperatures to 375° F.	CALOL CYLINDER OIL—135FX (Med., vis., lightly compounded, filtered)	High-speed or heavily loaded engines. Pressures to 150 lbs. gauge; temperatures up to 400° F.	CALOL CYLINDER OIL—125PX (Med. vis., compounded Pennsylvania)	Pressures to 160 lbs. gauge; temperatures to 450° F. For same conditions as Calol Cylinder Oil — 135FX when non-compounded oil desired. Marine reciprocating engines with condensers.	CALOL CYLINDER OIL—150P (Med. vis., uncompounded Pennsylvania)
Stationaries, donkeys, pumps, locomotives, etc. —excessive moisture at throttle. Pressures up to 150 lbs.; temperatures up to 370° F.	CALOL VALVE OIL—130X (Med. vis., heavily compounded)	Steam cylinders. Pressures from 140 lb. gauge to 200 lb. gauge; temperatures up to 450° F.	CALOL CYLINDER OIL—155X (Med.-heavy vis., compounded)	Dry and saturated steam and slight moisture conditions. Pressures to 160 lbs. gauge; temperatures to 450° F.	CALOL CYLINDER OIL—140PX (Med. vis., compounded 100% Pennsylvania)	Corliss, poppett and piston-valve type engines and locomotives. Dry, saturated and high super-heat steam. Pressures over 160 lb. gauge; temperatures to 700° F.	CALOL CYLINDER OIL—190PX (High vis., compounded 100% Pennsylvania)

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

STANDARD OF CALIFORNIA

BACK PRESSURES UP
...160 POUNDS
...220 POUNDS!



Result: Lowest power costs at new synthetic rubber plant with Worthington-Moore turbines

In Canada's new government-owned synthetic rubber plant, operated by Polymer Corporation, Ltd., Worthington-Moore high back pressure steam turbines have permitted considerable savings in power costs. In this, Canada's largest steam plant installation, engineered by H. G. Acres and Company, power is produced as a by-product, since all exhaust steam is used for plant operation.

Three Worthington-Moore 1650-hp. geared multi-stage turbines are illustrated above as installed. These topping turbines operate with steam at 400 lbs. initial pressure, 650°F. temperature, and exhaust against 160 lbs. back pressure. Two 1000-hp. Worthington-Moore turbines, exhausting to 220 lbs. back pressure, were also selected.

Save Money in Modernizing Steam Plants

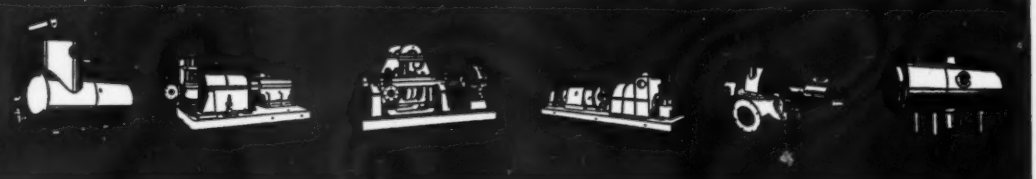
Worthington-Moore turbines operating against unusually high back pressures have enabled many plants to install modern high-pressure boilers without scrapping existing low-pressure apparatus. Write for complete details. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, New York.*

WORTHINGTON *BEHIND THE NAME*

MOORE

MM-7

A GREAT TEAM IN STEAM



No. 1 MAN in COOLING TOWERS

. . . Because of the EXTRA BENEFITS

he delivers before the negotiation even begins . . . the advantages inherent in a sound, strong organization that, by every standard of comparison, leads its field.

In cooling towers, the most reliable guarantee of long and satisfactory service that can be had is the company name on this man's brief case. It stands for:

★ FACILITIES

PLANTS, EQUIPMENT, PERSONNEL, INVENTORIES, ETC., of the calibre to execute *all* contracts of *any* magnitude *quickly* and smoothly.

★ EXPERIENCE

TIME-TRIED PRODUCTS backed by the accumulated working knowledge of many hundreds of applications annually, covering all types and capacities in every variety of service.

★ RECORD

CONSISTENTLY LARGE OUTPUT steadily swelling a broad list of installations. HEAVY REPEAT BUSINESS from nationally-known firms.

★ SERVICE

APPLICATION ENGINEERS conveniently located in all major cities to provide *confidential consultation* and engineering analysis of water cooling problems. SOUND RECOMMENDATIONS to meet individual requirements and conditions. VETERAN ERECTION SUPERVISORS to direct fast, skilled installation of the equipment by capable crews. WAREHOUSE STOCKS of replacement items. FIELD TEST SERVICE equipped to make operating studies.

★ LEADERSHIP

PROVEN DEVELOPMENTS both in general designs and component features, many patents and "exclusives." REPUTATION for originality and numerous "firsts." CONTINUOUS RESEARCH contributing to the advancement of the whole industry.

•

On any water cooling problem — CALL MARLEY! Or write for the thorough-going, well-illustrated bulletin covering equipment of the specific type and size for YOUR application. The Marley line is COMPLETE!

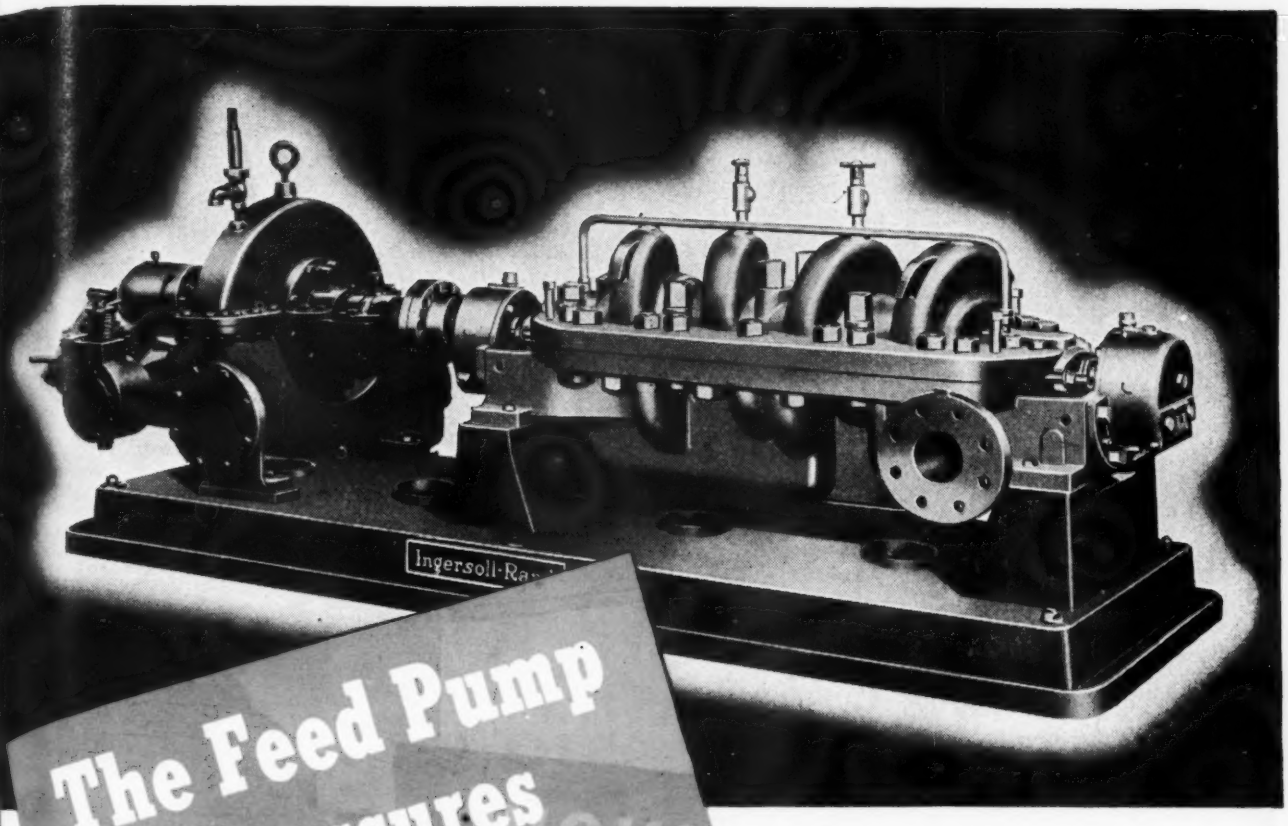
MARLEY

COOLING TOWERS

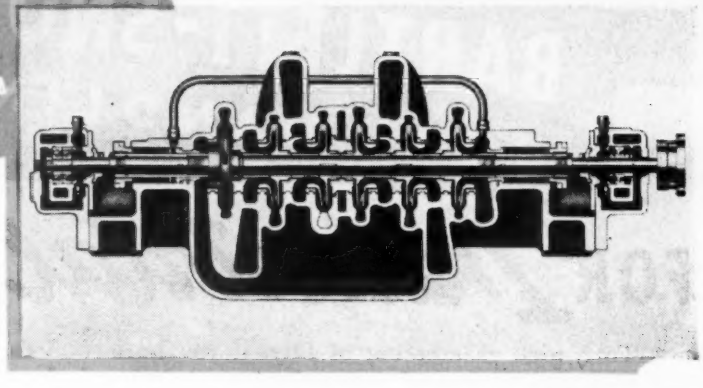
–for DETAILED INFORMATION see Sweets Files, Refinery Catalog, Chemical Engineering Catalog and others 45-A

Factories: Kansas City, Kansas, and Stockton, California

THE MARLEY COMPANY • FAIRFAX & MARLEY RDS. • K. C., KANS.



The Feed Pump for Pressures up to 800 lb.



Note simplicity of design and construction.

The Class CNT boiler-feed pump is an improved version of a multi-stage unit which has proved its efficiency and dependability in hundreds of land and marine boiler plants.

This new CNT quickly proved its stamina. Some of the features that make it an ideal boiler-feed pump are:

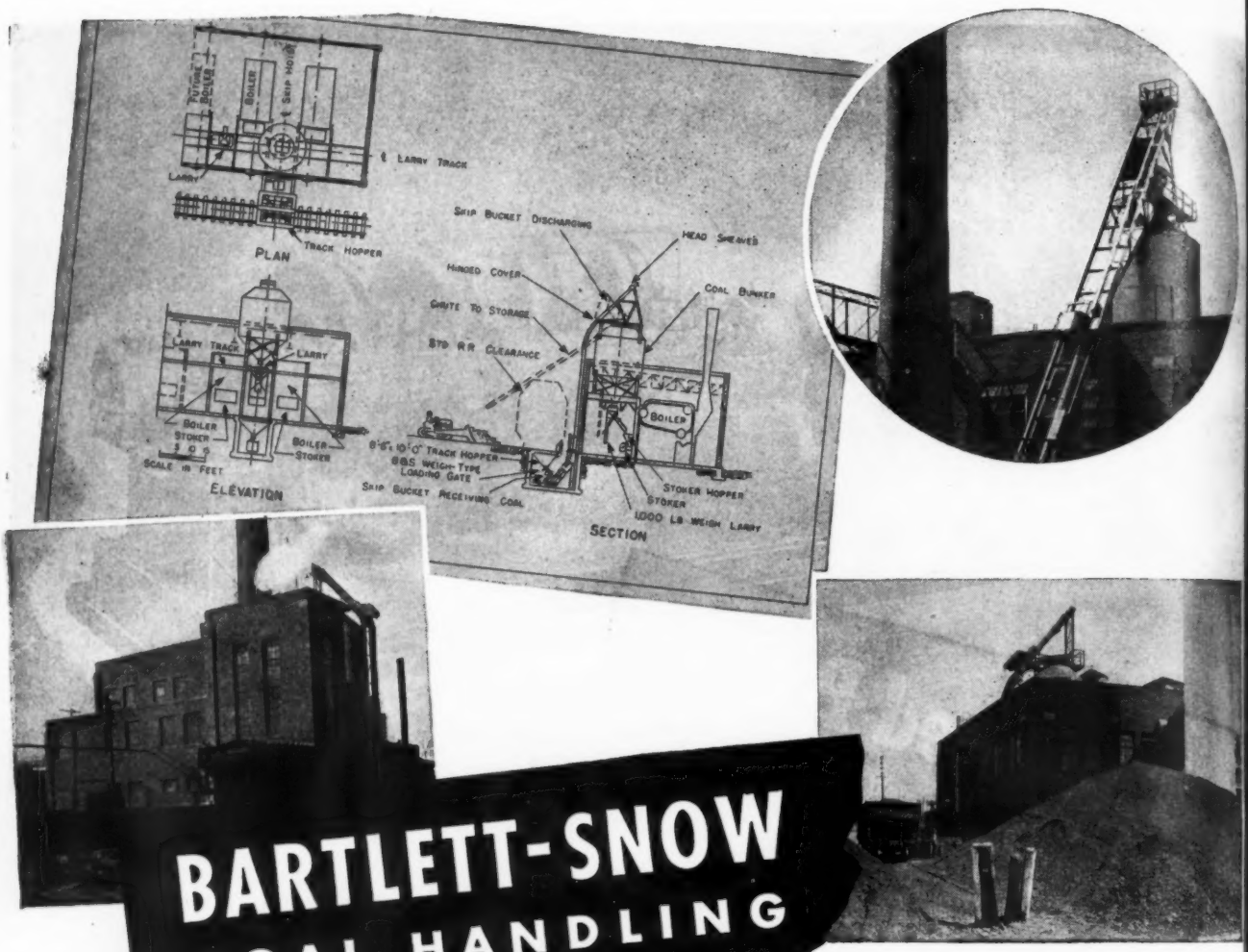
1. **It can be built of materials selected by the I-R metallurgical department to suit any type of boiler-feed water; yes, it is even available with stainless steel casing.**
2. **Extra large oil-lubricated bearings support the rotor. Ball bearings are standard; sleeve bearings can be furnished as an alternate.**
3. **The highly efficient impellers are mounted with opposed inlets and staggered discharge volutes to give complete hydraulic and radial balance.**

Let an Ingersoll-Rand pump engineer give you details of other features such as: the symmetrical design; extra-deep, low-pressure stuffing boxes; the sealed shaft sleeves; manufacturing methods and testing.

Class CNT pumps are available in capacities up to 700 gpm for pressures up to 800 psi. Other Ingersoll-Rand boiler-feed pumps are available for any and all boiler pressures in commercial use. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

Ingersoll-Rand 10-631

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES



BARTLETT-SNOW COAL HANDLING

FOR *Industrial* BOILER PLANTS

● Forty-nine chances out of fifty—if you burn from 30 to 200 tons of coal a day, you'll find a Bartlett-Snow Coal Handling System will meet your requirements *better,— cost less,—* be installed and ready for operation *sooner.*

You see,— we studied scores of our most outstanding installations,— Then took the best ideas from these "best" jobs — and — with more than forty years experience in this work developed, and completely engineered, a group of "ideal" coal handling arrangements for different sizes and types of small, medium and large size industrial boiler plants.

Each of these systems combines maximum dependability with low maintenance and low operating costs — can be installed in existing or new buildings — and altered easily to meet any yard or track condition. Because the major — and most costly — design and engineering work has already been completed — and "written off" — the purchaser gets more equipment for less money — faster — with only a minimum of "starting-up" adjustments.

Our Bulletin No. 83 gives full details,— and contains much information of interest to works managers, engineers, and power plant superintendents. Send for a copy.

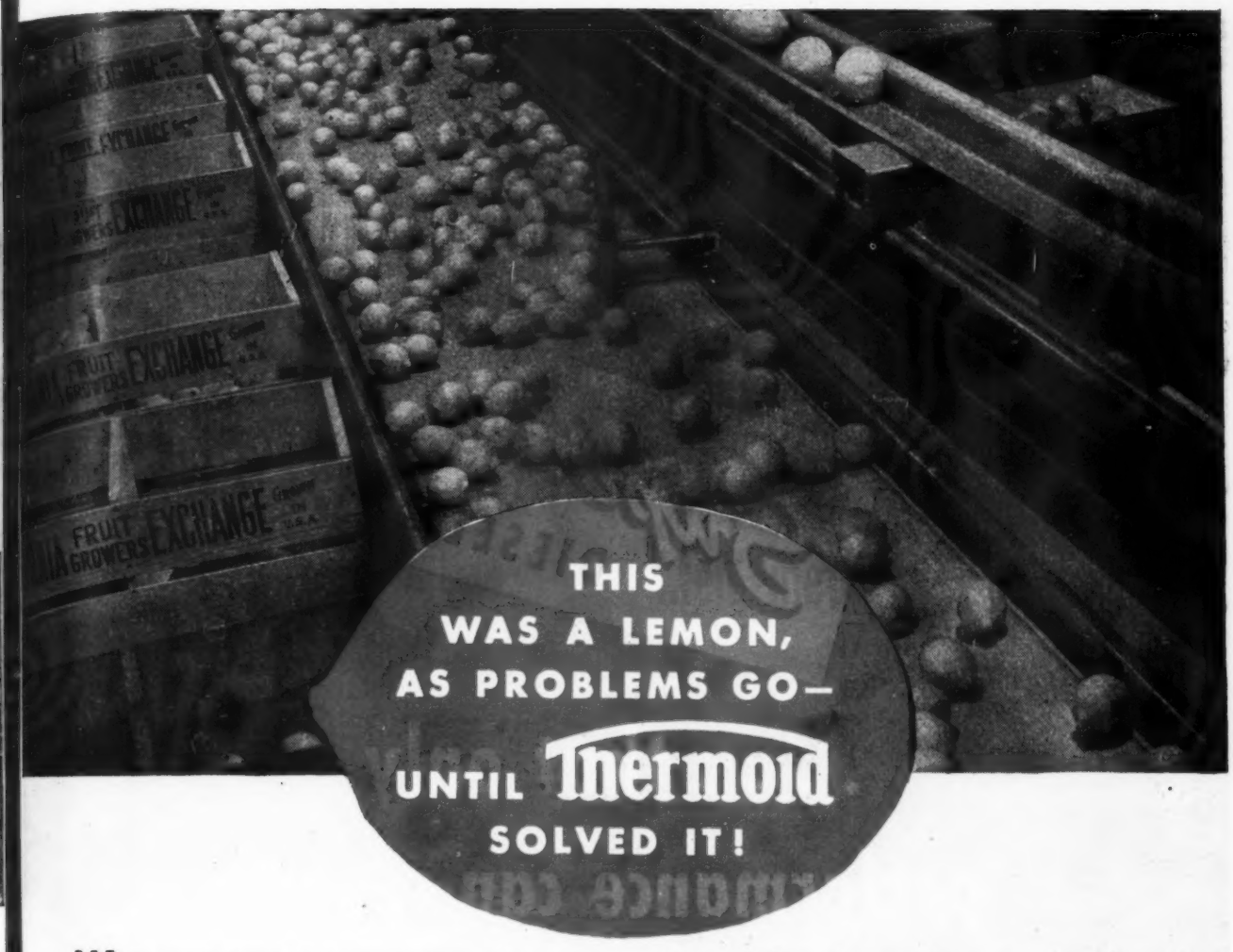
THE C. O. BARTLETT & SNOW CO.

6205 HARVARD AVENUE • CLEVELAND 5, OHIO

Engineering and Sales Representatives in Principal Cities

COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

TRACK HOPPERS • SKIP HOISTS • BUCKET ELEVATORS • BELT CONVEYORS
BINS AND BUNKERS • WEIGH LARRIES • FIELD STORAGE • ASH HANDLING



While studying the citrus fruit packing industry, Dr. McClelland discovered that lemon sorters and graders were suffering unusual eye fatigue, which could be corrected by using grading belts of a special color. Dr. McClelland then specified a color which would give sufficient contrast to the color of the fruit for efficient sorting and yet provide a softer background, restful to the eyes of the graders.

Thermoid worked with Dr. McClelland. We found there were three things to be considered in making this new conveyor belting: (1) Making belts match the colors specified; (2) Making the belt's surface impervious to fruit mold—also a surface which would be easily sterilized; (3) Making a belt with a surface that would not rub off or discolor the fruit.

Thermoid is the only company licensed to manufacture Dr. McClelland's "Easy on the Eyes" Conveyor Belting. When war time restrictions are lifted, Thermoid will manufacture more of this belting.

This example of problem-solving ability was taken from our files to demonstrate that Thermoid engineering, research and manufacturing facilities—and the services of Thermoid's field representatives—are at your disposal in the solution of *your* industrial rubber problems.

DON'T PUT IT OFF 'TIL TOMORROW
Buy More War Bonds Today!

Thermoid Rubber

DIVISION OF THERMOID COMPANY
TRENTON, NEW JERSEY

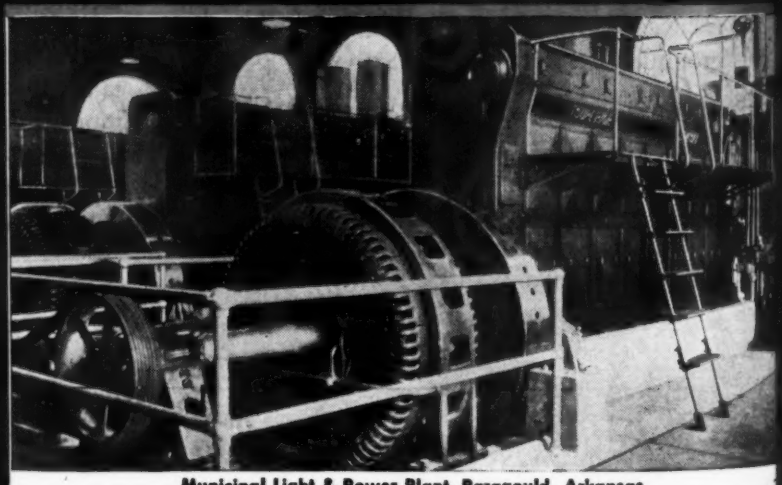
"IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID"

THE THERMOID LINE INCLUDES: TRANSMISSION BELTING • F. H. P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE • SHEET PACKINGS • INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • MOLDED HARD RUBBER AND PLASTIC PRODUCTS

There are Values in

Superior DIESELS

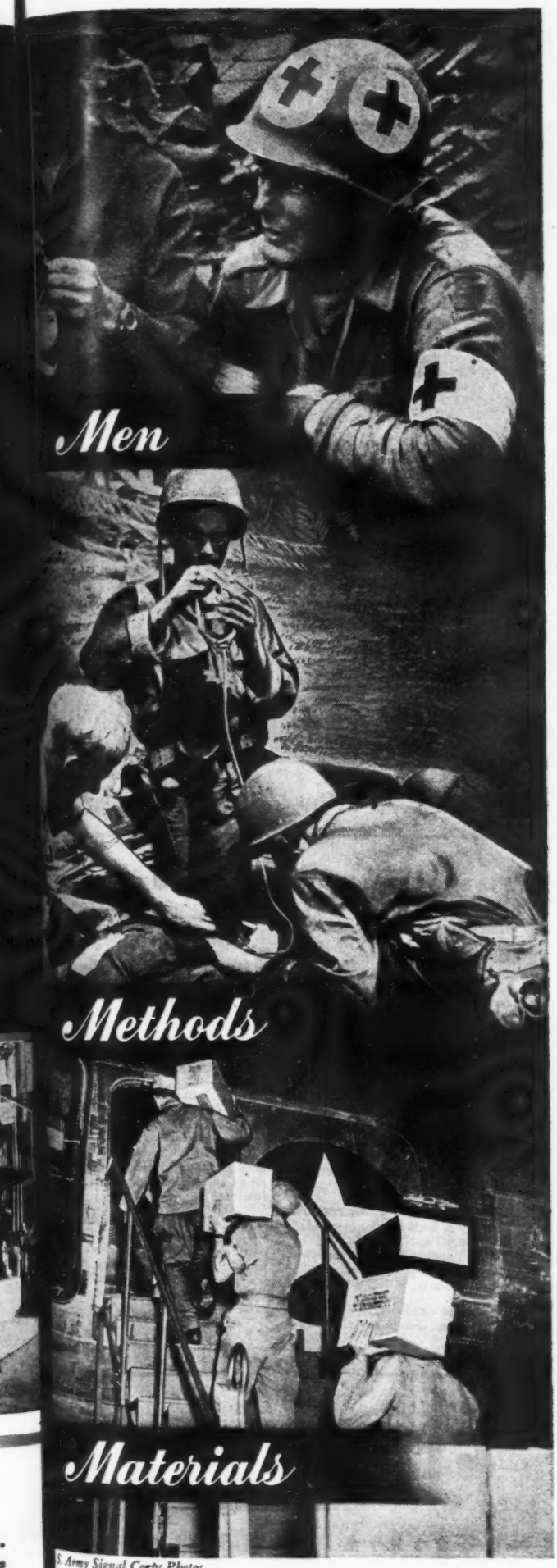
. . . . that only performance can reveal



Municipal Light & Power Plant, Paragould, Arkansas

SUPERIOR DIESELS • STATIONARY, 28 to 1325 H.P.
MARINE, 28 to 1325 H.P. • GENERATOR SETS, 20 to 930 kw.

• Superior **ENGINES**
Division of
THE NATIONAL SUPPLY CO.
Plant and General Sales Office: Springfield, Ohio



U. S. Army Signal Corps Photos

THE COMBINATION THAT SAVES LIVES

One of the dramatic medical advances of this war is the amazing record of life-saving through the use of plasma and whole blood. Thanks to this new procedure, there's a higher percentage of recovery than at any time in history. But blood alone does not give this result. It takes the combination of three factors: *Men*—trained medical corpsmen, *Methods*—simplified so that even in the front lines no delay is necessary, *Materials*—blood donated by every one of us! Remember over 100,000 pints are needed each week. Give blood. Be one of those who help save lives!

Men, methods and materials make for insulation efficiency

All the elements properly coordinated—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN . . . The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

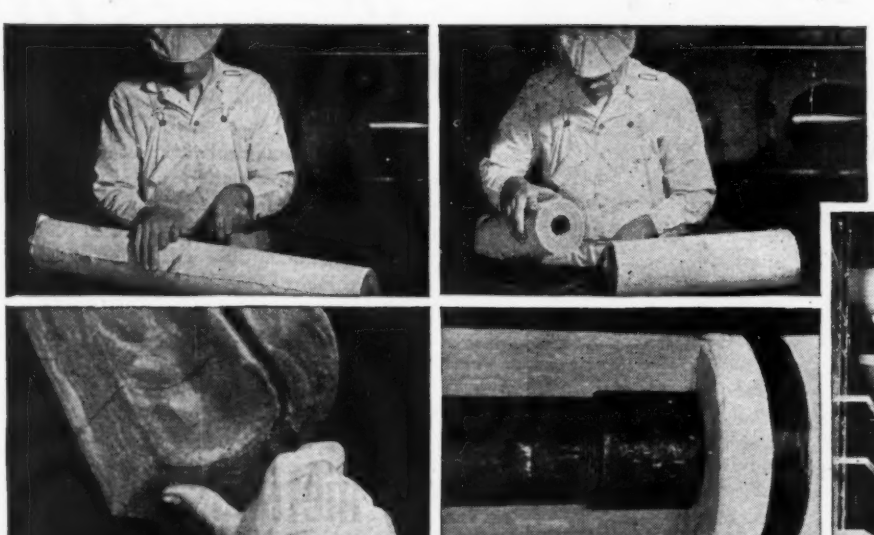
METHODS . . . Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all methods of application.

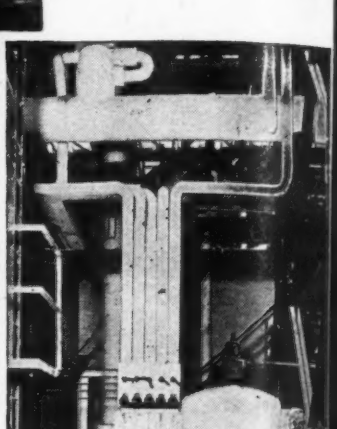
MATERIALS . . . The right insulation material to meet your specific temperature control problem. The Ruberoid line has no "gaps" in it from 0° to 1900° F.

RUBEROID
INSULATION
A complete service

Write for Ruberoid Insulation Guide and technical data.
The RUBEROID Co., *Executive Offices*, 500 Fifth Ave., New York 18, N. Y.
ASPHALT AND ASBESTOS BUILDING MATERIALS

★ easier-faster application





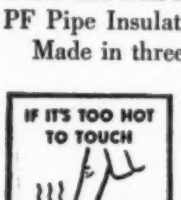
PF (Pre-formed)
PIPE INSULATION

...another reason for using

FIBERGLAS*

Cut it and trim it and fit it to size—installing Fiberglas PF Pipe Insulation over couplings is as easy as that.

Made in three-ft. sections, lightweight PF is easy to handle. It can be cut with an ordinary knife to form a snug fit with minimum loss of insulation thickness and efficiency. Couplings are invisible when work is finished. The fibrous ends of the sections intermesh to form tight joints.



In co-operation with the Government program to save critical fuel.

Fiberglas PF Pipe Insulation is made of fine glass fibers bonded with a thermosetting binder and molded into standard sections and segments. It is used for steam and other hot lines up to 30" O.D. with temperatures up to 600° F.

The unusually low thermal conductivity of PF results in significant savings in heat and power. Fiberglas does not rot or decay, disintegrate or pack down under vibration. And because of its mechanical strength, this pipe covering holds its shape, withstands handling and is easily applied even on the larger pipes where three segments are used.

For complete information about Fiberglas Pipe Insulations and the many other uses of Fiberglas, write for the booklet "Fiberglas Insulations for Industry," *Owens-Corning Fiberglas Corporation, 2000 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

FIBERGLAS INDUSTRIAL INSULATIONS

1. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3" O.D. Will withstand temperatures up to 1000° F.

2. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Lightweight and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

3. No. 600 PF Block—Same materials as in PF Pipe Covering — in blocks 6" x 36" and 12" x 36", standard thicknesses.

4. OC-1800 High Temperature Block—A highly efficient molded block in sizes 3" x 18" and 6" x 36" and 12" x 36"—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic Finish—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. Insulating Wool, Type TW-F—Available in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces.

8. PF Insulation—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24" x 48", 1" to 4" in thickness, according to density. For insulated panels, sound absorption and various semi-structural applications.

9. PF Roof Deck Insulation—9 lbs. density with facing to facilitate mopping. Highly efficient, with incombustible, rotproof and moisture-resistant core, for application under industrial built-up roofings. Sizes 24" x 48". Thicknesses from $\frac{13}{16}$" to 2".

ARMY E NAVY

FIBERGLAS

*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATION

—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—

BURGESS SNUBBER BULLETIN for Diesel Exhaust Noise Control

A TYPICAL CAUSE OF POOR ENGINE PERFORMANCE

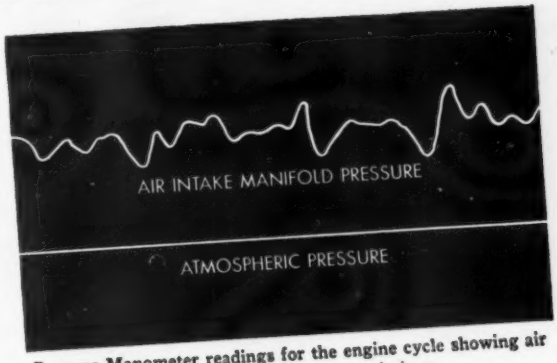
In previous articles we have discussed the effect of the Burgess Snubber on the air intake of a Diesel engine or compressor . . . how the Snubber is used to eliminate resonance, ramming, and pulsations in the air intake system.

Some air intake problems are simple to solve . . . others are particularly knotty, in which case the Burgess engineer is frequently called for consultation and advice.

One interesting problem recently developed in a Diesel electric power plant equipped with a low speed, heavy duty, two-cycle, 10-cylinder Diesel engine with separate scavenging centrifugal blower. Complaints on the installation developed because of a pronounced low frequency pulsation in the air intake of the centrifugal blower. The low frequency pulsation was exactly opposite of what might be normally expected, since the blower speed was 3600 rpm and engine speed only 300 rpm.

The engine was equipped with an oil bath air filter and the pulsations were severe enough to splash oil out of the cleaner oil pan. Also, the audible low frequency sound emitted from the blower intake caused visible vibration of objects adjacent to the filter house.

Before the Burgess engineer was called in, the utility undertook to solve their own problem by installing a second oil bath air filter. This improved the condition only slightly.



Burgess Manometer readings for the engine cycle showing air intake manifold pressure variations.

Burgess manometer tests showed that the pressure fluctuations were having no serious effect on engine scavenging, because the air intake manifold pressure was constantly well above atmospheric pressure. The pulsations, therefore, must be the result of a scavenging condition reflected back through the air intake system.

At the conclusion of the tests, the Burgess engineer suggested the installation of a Burgess Snubber to eliminate the air intake noise and reduce the pulsations in the air intake system.

The Burgess manometer, which records instantaneous pressure fluctuations and provides readings at any point during the engine cycle, has solved many similar air intake and exhaust problems on Diesel engines.

* * *

BURGESS EXHAUST SNUBBER STC SERIES

The STC Series Burgess Snubber is standard for exhaust systems of internal combustion engines, blowers, and vacuum pumps which discharge to atmosphere. The construction of the STC Series Snubber is based on the most advanced knowledge of hydrokinematics of exhaust systems.

The Burgess principle of silencing is based on the theory of "snubbing" the slug of exhaust gas . . . hence the name, Snubber. The slug of fast-moving exhaust gas passes through successive snubbing chambers where the kinetic energy of the exhaust gas is dissipated so that it reaches the atmosphere in a quiet, steady flow. With the Burgess Exhaust Snubber, there is no need to tune the exhaust system to overcome bad exhaust effects.

There is no "second best" Burgess Snubber line. The combination of fine engineering talent and high quality materials can result in only one design and one manufacturing standard. The Burgess STC Series Exhaust Snubbers are constructed of heavy gauge steel and welded throughout to combine strength and lightweight. A typically important Burgess construction detail is the mechanically rigid dome-head construction . . . scientifically correct for the ideal Snubber.

Diesel engine men can do well to investigate the Burgess Snubber line. Burgess engineers will be glad to recommend the correct exhaust Snubber for any engine application.

NEW BOOKLET TELLS A STORY OF SOUND

Diesel engineers and operators of Diesel engines will be interested in reading the new 36-page Burgess-Manning booklet, "A Story of Sound," just released for distribution.

"A Story of Sound" discusses such subjects as: What is sound? What are sound waves? Why are sound waves different? How can we measure sound? What is a sound level? What is a decibel? What does an acoustic engineer do?

"A Story of Sound" is valuable to the Diesel engineer for a better understanding of noise problems. Copies are now available upon request.

Published by BURGESS-MANNING COMPANY Chicago, Illinois

COPYRIGHT 1945—BURGESS-MANNING COMPANY

—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—

MPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—

One of many examples of long, trouble-free operation assured by "CARBOFRAX" *brick*

This photograph shows one of four boilers fired with under-feed stokers equipped with "CARBOFRAX" silicon carbide brick along the fuel line. These boilers are operated about nine months of the year and are shut down for the remaining three months. Their rating runs around 150%. At the time the picture was taken, "CARBOFRAX" brick had been in service 9½ years. When fire clay brick were used in the same section, they had to be completely re-set at the end of the nine months' run. Considerable patching was necessary every three months.

The record of "CARBOFRAX" brick in this particular installation shows their unique properties and use in boiler furnaces. Here are their advantages:

High refractoriness. Even at elevated temperatures, "CARBOFRAX" brickwork does not soften. Clinker cannot penetrate its hard, dense face.

Outstanding resistance to abrasion. These brick are impervious to both flame and mechanical abrasion. Such resistance is provided by their main component —"CARBORUNDUM" silicon carbide.

Low spalling tendency. "CARBOFRAX" brick offer unusual resistance to spalling and cracking. This has been fully proven by broad field experience.

With "CARBOFRAX" brick on the job, the furnace walls are easy to clean. The fire is more active. Outages for lining repairs are few.

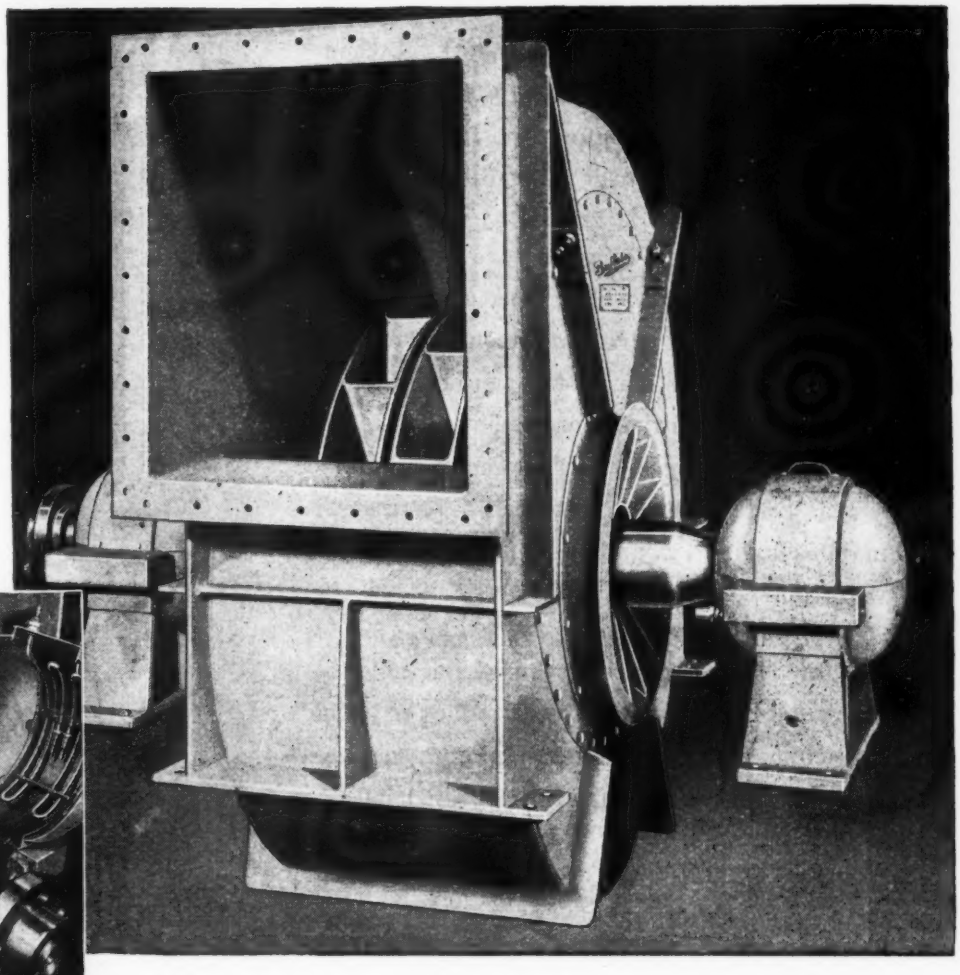
Investigate "CARBOFRAX" brick for your boiler settings. Write The Carborundum Company, Refractories Division, Dept. J3, Perth Amboy, N. J.

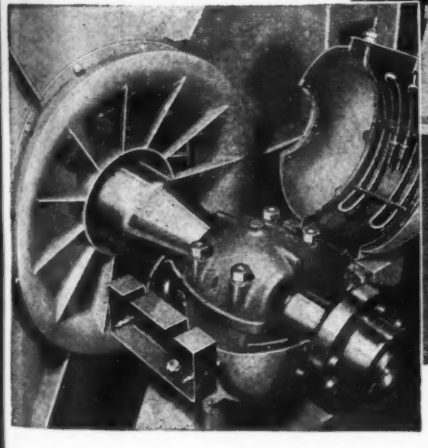
"CARBORUNDUM" and "CARBOFRAX" are registered trade marks of, and indicate manufacture by, The Carborundum Company.

Super Refractories by CARBORUNDUM TRADE-MARK

Handling Air at 100° below Zero

Sturdy construction is combined with high efficiency in this special Buffalo low temperature fan. Small illustration shows Calrod-lined bearing cover lifted. Lower part of bearing cover is also lined with Calrod.





When you're flying at 40,000 feet, it's important that instruments function properly, that motors operate smoothly—that valves and meters respond as they should. In order to check all this equipment before it's in the air, testing laboratories reproduce stratosphere conditions on the ground.

"Buffalo" fans have been chosen for circulation of air in many of these laboratories.

The special Buffalo fan illustrated above is for one of the latest and most complete testing plants. Designed to handle 62,400 cfm at 4½ lbs. (equivalent to 120 inches of water pressure) this fan must also handle a temperature range from 100° above zero to 100° below. While the 200° differential is nothing exceptional, many commercial jobs having a much wider range, the low temperature involved produced interesting lubrication problems. To give proper bearing performance SKF oil-lubricated bearings were used. To keep bearing-oil fluid, Calrod heating coils have been placed in a special bearing cover, which is arranged for easy inspection.

When your fan problems call for an unusual degree of engineering ability, let Buffalo engineers make recommendations.

"Buffalo" "First For Fans"

BUFFALO FORGE COMPANY

488 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co. Ltd., Kitchener, Ont.

fan *for* industry

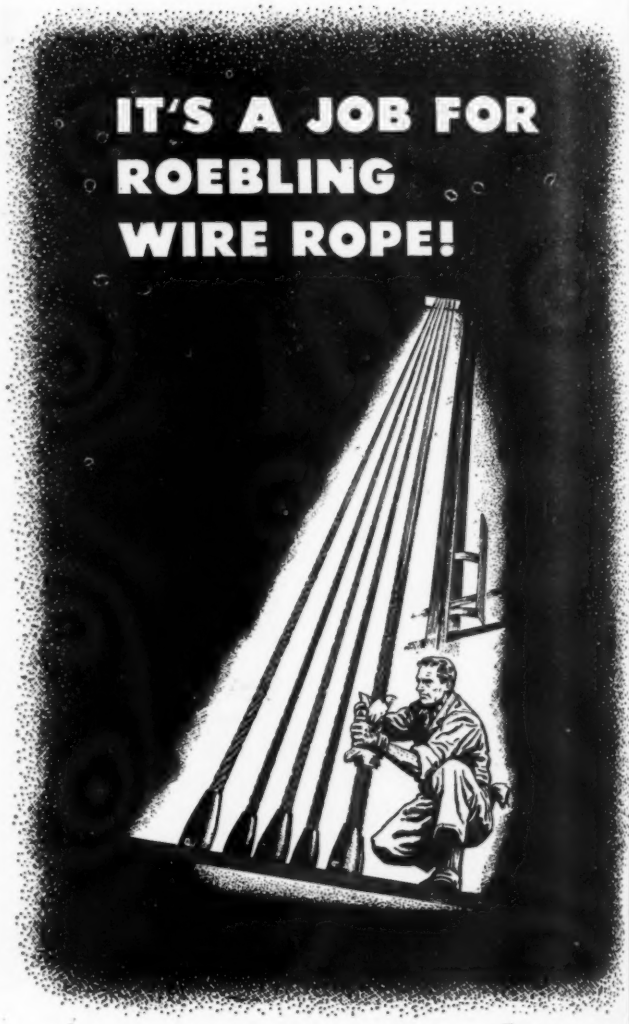
Adding Savings to Safety...

BRINGING SERVICE COSTS *down* helps send your building's profits *up*. Whether it's a skyscraper—or a loft . . . when elevator operation costs have to be lowered—with absolute safety—it's a job for Roebling Special "Traction Steel" Elevator Rope.

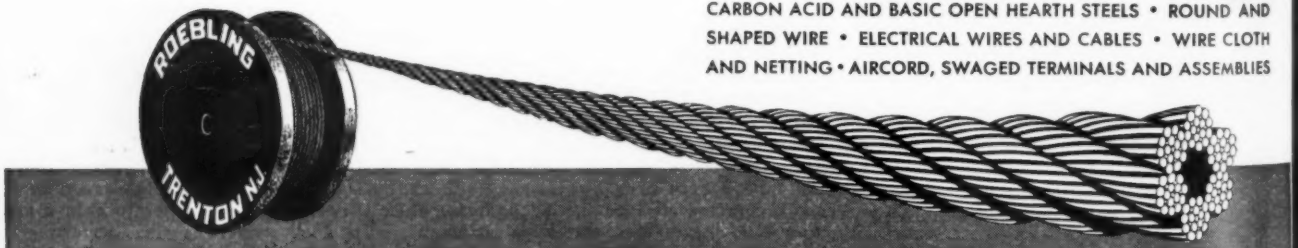
After all, the basis of good wire rope is the steel in the wires. Roebling Special "Traction Steel"—the finest wire rope steel produced—is custom-made in our *small* open-hearth furnaces, where quality is closely controlled. Add 104 years of experience in rope-making . . . unsurpassed facilities for research — testing — manufacturing . . . and *you* get the utmost in wire rope value.

Roebling engineers are at your service . . . to help you select the rope most suitable for your particular need . . . and get maximum service from it. Call or write our nearest branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities



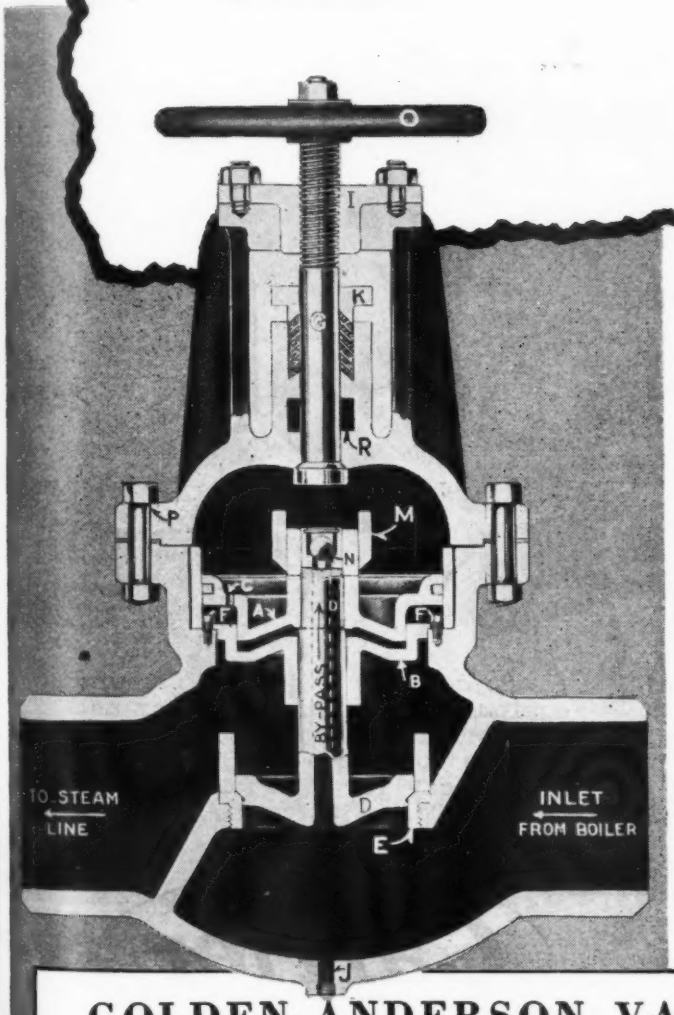
WIRE ROPE AND STRAND • FITTINGS • SLINGS
AERIAL WIRE ROPE SYSTEMS • SUSPENSION BRIDGES
AND CABLES • COLD ROLLED STRIP • HIGH AND LOW
CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND
SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH
AND NETTING • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES



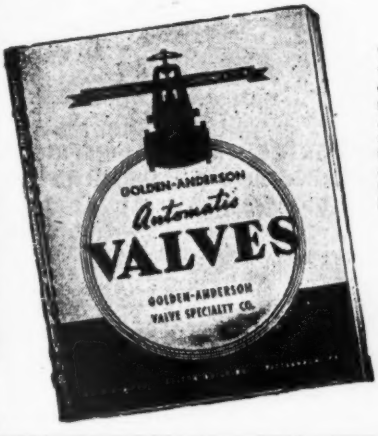
ROEBLING

PACEMAKER IN WIRE PRODUCTS

What would happen if a Tube blew in *your* Boiler Room...?



Plenty *could* happen—such as the whole battery exploding through the ruptured point . . . but nothing *can* happen if your boilers are equipped with these Triple-Acting Non-Return Valves! In the event of a blown tube or a pressure line break this valve will immediately cut off the flow of steam, isolating the boiler and preventing any possible damage.



This is only one of the wide variety of Specialty Valves regularly supplied by GOLDEN-ANDERSON. Write for our catalog. It contains complete, specific application and operation data on all G-A Specialty Valves.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

Manufacturers of Special Valves for Every Need

Fulton Bldg. Pittsburgh, Penna.

QUIZ:

What are your problems?

Cooling special brine to low temperatures — in a range from minus 50° F. to minus 100° F.?

Cooling salt brine to temperatures — in a range from minus 40° F. to plus 35° F.?

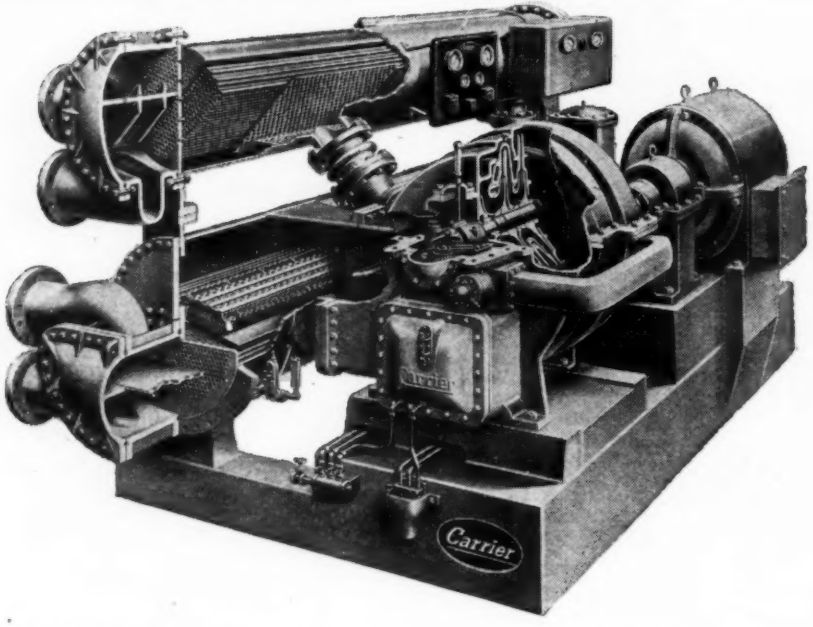
Cooling water in a range from 34° F. to 70° F.?

Controlling heat of reaction?

Condensing vapors or gases, such as chlorine, hydrocarbons, solvents, ammonia or carbon dioxide?

Adapting refrigerating system to your plant heat balance?

ANSWER:



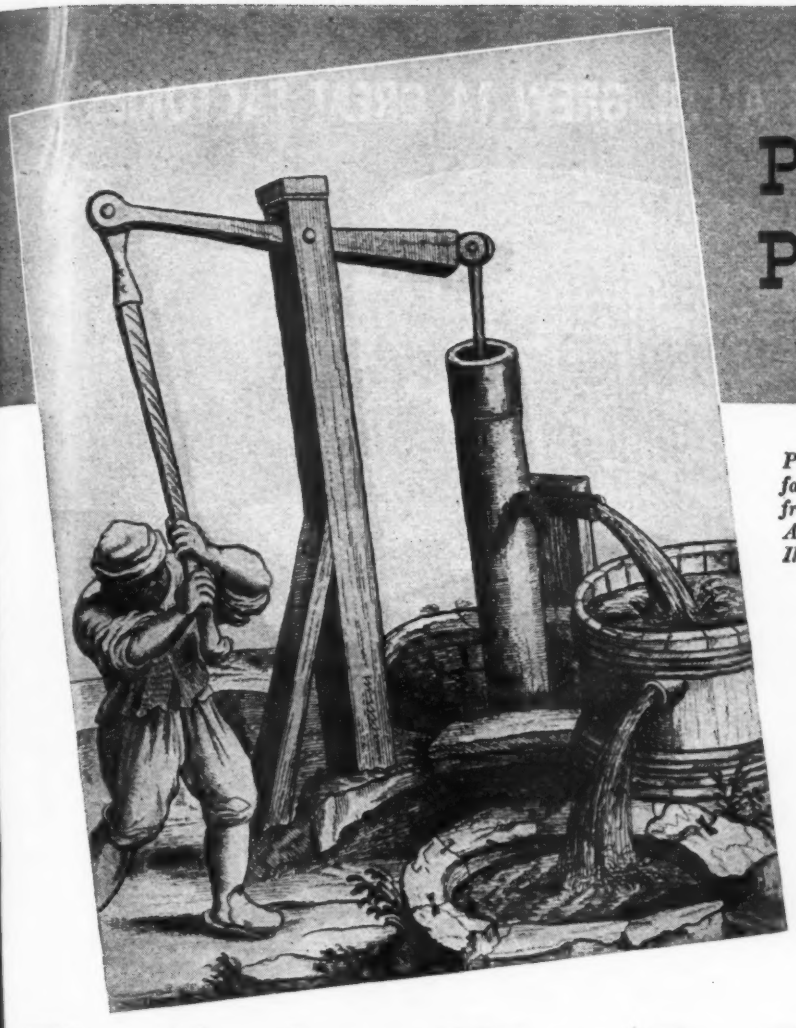
THE CARRIER CENTRIFUGAL REFRIGERATING MACHINE has proved the most satisfactory answer to large capacity requirements because of its inherent superiority of engineering and construction. Back of it are more than 20 years of design, manufacturing and operating experience ... The life of the Carrier Centrifugal Compressor is greater than any other type of compressor or rotating machine. There are no wearing parts in the compressor proper — and no erosion or wear at points of clearance ... Compressor efficiency is sustained for the life of the compressor because nothing occurs to change it. So dependable is this Carrier equipment that in many important industrial processes no spare unit is considered necessary. Write today for full information. Carrier Corp., Syracuse, N. Y.

Carrier

AIR CONDITIONING · REFRIGERATION

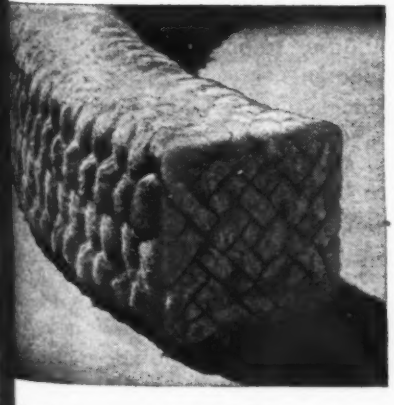
INDUSTRIAL HEATING

PRIMITIVE PUMP—1650



Primitive pump used on an Italian farm during the 17th Century—from a copper engraving by Athanasius Kircher, 1601-1680. Illustration from Bettmann Archive.

That's One Way To Pump Water



ARLOCK LATTICE-BRAID PACKING

he unique structural design imparts mi-automatic pressure action. Avail-ble in several styles for service on mps and other equipment.

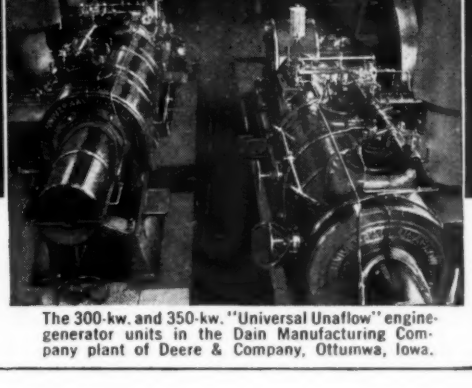
THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
Canada: The Garlock Packing Company of Canada, Ltd., Montreal, Que.

The lift pump used by the farmers in Europe some four hundred years ago seemed to do a fairly good job according to this old-time illustration. But it's a far cry from the modern high-pressure and high-speed pumps in use today. Pump valves, packings, gaskets and oil seals have also improved through the years—keeping pace with engineering advancements in the equipment in which they are used. Today the complete line of Garlock products fills every need of modern industry.

Garlock

• FROM JOHN DEERE'S ANVIL GREW 14 GREAT FACTORIES

JOHN DEERE
QUALITY FARM EQUIPMENT



SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES
Generate Electric Power in 7 of These Plants

The 300-kw. and 350-kw. "Universal Unaflow" engine-generator units in the Dain Manufacturing Company plant of Deere & Company, Ottumwa, Iowa.

FROM Vermont in 1836 a Yankee started west, carrying with him a small bundle of tools and a much smaller bundle of cash. But John Deere also carried with him a thorough mastery of the mechanic and blacksmith trades, as well as inventive genius and breadth of vision.

In the waxy, black soil of the prairies that stuck to the old-fashioned iron plows, John Deere found his opportunity. He believed that steel was the answer—and proved it. His plow, fashioned from a broken saw blade salvaged from a neighboring sawmill, was an immediate success and became known as "John Deere's Self-Polisher."

From this small beginning, over a hundred years ago, the House of Deere has been inseparably linked with agricultural equipment, such as plows, corn and cotton planters, hay machinery and scores of other items in its complete line of farm implements.

Skinner Engine Company is proud of its long and happy association with Deere & Company. Economical, dependable power is being generated in seven Deere plants by nine Skinner "Universal Unaflow" Steam Engines—with efficient use of the exhaust steam for heating and processing. This is not an unusual example, for in practically every type of industry savings are being made where far-sighted management is using Skinner engines for electric power generation. It will pay you to investigate the possibility of substantial savings in your own business. Case studies pertaining to your particular industry will be sent upon request.

ARMY (E) NAVY

Do More Than Before—Buy EXTRA War Bonds

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Arsenic as a Corrosion Inhibitor... Increasing Condenser Tube Life

The rate at which condenser and heat exchanger tubing is attacked by corrosion may be influenced by the presence of a corrosion inhibitor in the liquid or in the metal or alloy itself. Therefore, it is worth the time of every power plant operator to have some knowledge of the importance of corrosion inhibitors. Since space is limited, this article is confined to a discussion of some of the benefits gained by adding the inhibitor, arsenic, to certain condenser tube alloys.

As far back as 1908, A. S. Dwight discovered that the addition of arsenic trioxide to cooling water contaminated by sulphuric acid from smelter fumes retarded the corrosion of steel jackets. In 1924 G. D. Bengough and R. May added arsenic trioxide to a solution of cupric chloride, and reported that it inhibited copper deposition (a reaction associated with dezincification) on 70-30 brass when the ratio of concentration of arsenic to copper in the solution was approximately 1 or more. Thus, arsenic was shown to affect the corrosion products of brass, and through them the corrosion rate of the alloy itself. As a result, Bengough and May undertook further experiments to determine what effect the addition of certain elements to the metal itself would have on the dezincification of brass. They discovered that 70-30 brass containing as little as .02% arsenic resisted dezincification, and that even .01% arsenic was effective. Another investigator, C. F. Nixon, who conducted experiments during the same year, reported that brass containing less than .3% arsenic showed great resistance to dezincification. A series of tests conducted in our own laboratories at Bridgeport have yielded interesting data regarding the effect of arsenic added to several condenser tube alloys. Two series of tests were run—one in artesian well water and another in sea water.

Artesian Well Water

These tests were conducted in slowly-flowing artesian well water heated to approximately 150° F. The water had a pH value of 5.3 (quite acid). ASTM sheet tension specimens cut from .050" thick sheets of Muntz Metal and Aluminum Brass were used. The depth of corrosion was calculated from the average loss in tensile strength after immersion for 120 days. The non-inhibited Muntz Metal was removed after 40 days because of excessive corrosion, and consequently its corrosion rate was multiplied by 3 in order to make the values comparable.

As may be seen from Table I, the addition of .02% arsenic to Muntz Metal practically eliminated dezincification and cut the general corrosion rate about one-third. In the case of Aluminum Brass, the addition of .02% arsenic practically eliminated localized dezincification, while the overall general corrosion rate remained about the same.

Alloy	Average Depth of Corrosion	Description of Attack
Muntz Metal	.043"	Dezincification fairly uniform with some deep penetrating plugs.
Arsenical Muntz Metal	.012"	No dezincification. General uniform corrosion with a few minute pits.
Alum. Brass	.0006"	Scattered plug type dezincification, with large deep plugs completely penetrating the specimens.
Arsenical Alum. Brass	.0005"	General uniform corrosion with slight roughening of the surface.

Sea Water Tests

Samples of Admiralty, Muntz Metal and Naval Brass were immersed for one year in clean moving sea water. The test was conducted with ASTM sheet tension specimens .050" thick with bakelite rods and spacers to prevent any possibility of galvanic corrosion. Results indicated that the addition of .04% arsenic to Admiralty not only helped inhibit dezincification, but also lowered to a small degree the overall corrosion rate. The addition of .10% arsenic to Muntz Metal inhibited dezincification in sea water to a marked degree. In fact, that amount of arsenic had an effect almost equal to that of .75% tin which, in that amount, also acts as a dezincification inhibitor. Table II summarizes the results of these tests.

Arsenic In Bridgeport Alloys

It will be observed from the foregoing that the use of arsenic as a corrosion inhibitor has been known for a number of years. The results of field and service tests have proved the soundness of Bridgeport's policy of adding arsenic to Cuzinal (aluminum brass), Admiralty, Muntz Metal and some other alloys to inhibit dezincification and increase service life. Listed below are Bridgeport standard condenser tube alloys to which arsenic has been added to increase service life.

Duronze IV (approximately 95% copper 5% aluminum, with a trace of arsenic) considered one of the finest condenser tube alloys made. Resists general corrosion and air impingement corrosion. Especially recommended for seaboard power stations using brackish water polluted by sewage and factory wastes.

Arsencial Admiralty—Resists dezincification and gives good service with low velocity fresh or salt water polluted by sewage.

Cuzinal (aluminum brass)—Resists dezincification. Has more resistance to air impingement corrosion than does Admiralty, and consequently is suitable for use where higher velocities of water are used.

Arsenical Muntz Metal—Resists dezincification. A moderately priced alloy suitable for use where good fresh water conditions exist.

Arsenical Copper—Pure copper alloyed with a small amount of arsenic is apparently more resistant to corrosion than ordinary copper. Recommended for fresh water condensers and for use as heater tubing.

Effect of Arsenic as an Inhibitor of Dezincification when alloys are tested in flowing Sea Water for 1 year (Average of 4 tests)

Alloy	Depth of Penetration Based on Loss in Tensile Strength Inches per year, ipy	Depth of Penetration Based on Loss in Weight in inches per year, ipy.	Remarks
Plain Admiralty Metal	0.00283	0.00178	Uniform with trace of dezincification
Arsenical Admiralty	0.00237	0.00160	No dezincification detected
Plain Muntz Metal	0.00888	0.00229	Badly dezincified
Arsenical Muntz Metal	0.00309	0.00210	No dezincification detected
Naval Brass	0.00261	0.00183	No dezincification detected.

Bridgeport's laboratory has accumulated much valuable data regarding the life of condenser tube alloys under service conditions. This data should be of value to power plant operators who are considering retubing, and who wish to obtain longer life and more satisfactory service than they have in the past. Your nearest Bridgeport representative will be glad to make our laboratory services available and help in the selection of the proper alloy for your particular water conditions.

Condenser Tube Manual

Every engineer should have a copy of Bridgeport's Condenser Tube Manual, containing corrosion research data, specifications, and information about Bridgeport's Condenser Tube Alloys.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN.

ARMY E NAVY

BRASS

ESTABLISHED 1865

TAKE IT TO ★ ★ ★

Headquarters

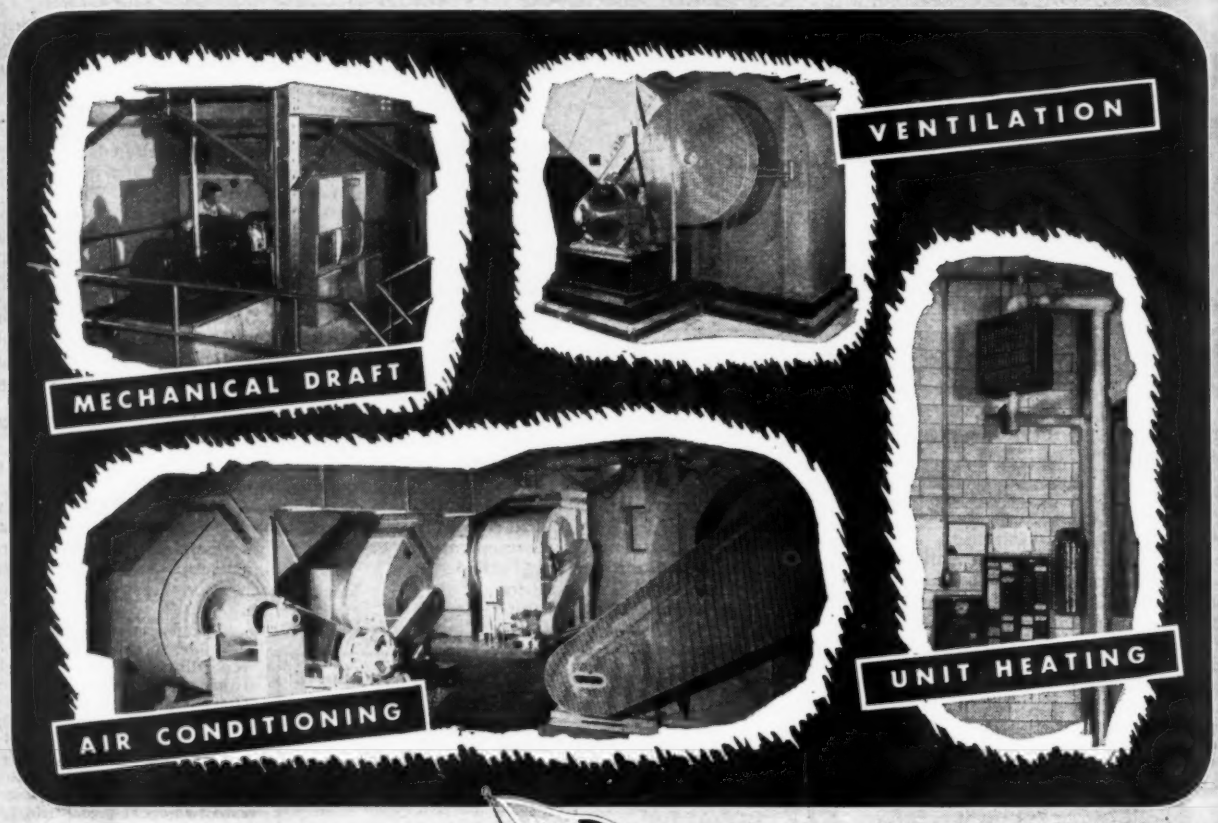
Call in the nearest Clarage Engineer

NEITHER your workers nor machines can do a creditable job, unless the air in your plant is clean, pure and correctly temperatured.

Are you letting production lag and costs mount, for want of the necessary air handling or conditioning equipment?

Thousands of plants — large and small — turn such requirements over to Clarage. We have developed, through more than a quarter-century of research and experience, the right engineering and the right equipment for any application.

Take your problem to "Headquarters" by writing or 'phoning us today. In every key city, there is a Clarage application engineering office ready to give you prompt, expert assistance.



NAVY

BUY MORE WAR BONDS!

CLARAGE

FAN COMPANY

Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

★ ★ ★ ★ ★ ★

from the CARDOX case record . . .

ut of actual on-the-job fire experience omes evidence of the ability of Cardox ire Extinguishing Systems to stop even ig fires *fast*. File No. S-63, taken from an vestigator's report on Cardox extinguish-ent of a tough transformer fire is a pical example:

"The fire occurred in the outdoor trans-rmer area. It was caused by a short in e 2500-volt bus section and quickly ig-ited a protective screen above the busses. his protective screen consisted of burlap, ubber sheeting and plywood.

"The Cardox System was actuated auto-atically and worked perfectly . . . in less an a quarter of a minute (after mass ischarge of Cardox CO_2 began) the fire as extinguished. No serious damage was one and operations were resumed fter a very small delay. The swift nd efficient operation of the Cardox ystem prevented at least $150,000 amage."

The danger spots in your plant may not be similar to the one described in FILE S-63. But, if for example they involve flammable liquids or electrical equipment of any kind, Cardox offers maximum protection with fast-acting, non-contaminating carbon dioxide . . . in *pounds* for small fires . . . and *tons* for large ones!

For all Cardox Systems have one outstanding characteristic which greatly increases the scope of usefulness and performance value of carbon dioxide in protecting *large* and *small* hazards!

This characteristic is the distinctive Cardox method of control and engineered application of liquid carbon dioxide, stored at 0° F. and 300 p.s.i. in a single storage unit containing from ¼ to 125 tons of fire-destroying Cardox CO_2 . . . enough to handle large fires in single or multiple hazards and leave an ample reserve for new emergencies!

If you have fire problems that are hard to handle, low pressure carbon dioxide can frequently provide the effective answer. A study of your specific fire hazards by Cardox Research Division and Engineering Staff puts you under no obligation. Write for Bulletin 965.

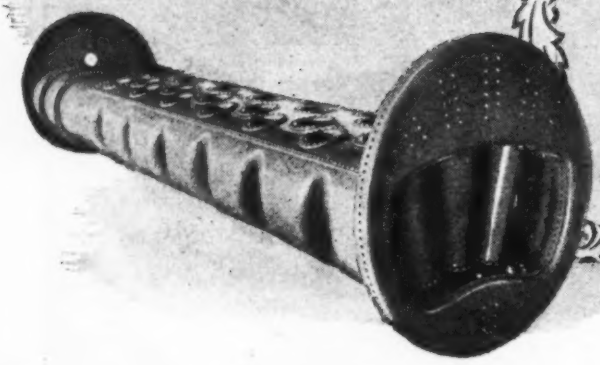
CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices in
New York, Washington, Detroit, Cleveland, Atlanta, Pittsburgh, San Francisco, Los Angeles, Seattle

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

Cardox CO_2 is supplied instantly in pounds or tons from a single Storage Unit containing 500 pounds to 125 tons at controlled low temperature of 0°F. and 300 p.s.i.

Since 1878 . . .

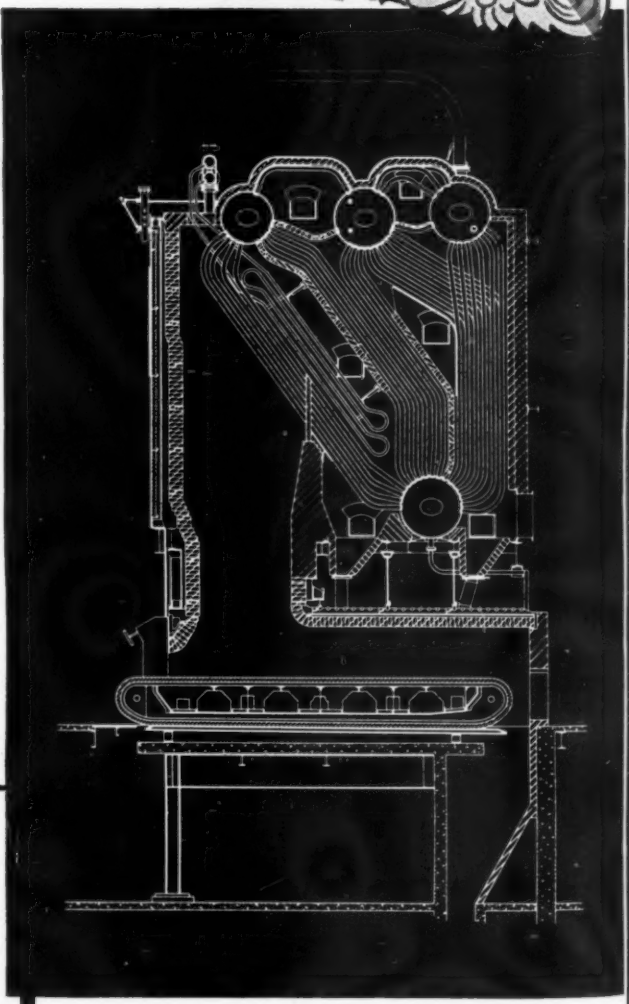
Steam Generating Equipment
by EDGE MOOR



How many power engineers can identify the illustration at the left? It is the internal flue of an "Improved Galloway Boiler," an outstanding type in its day. Edge Moor began building Galloway boilers in 1878—and have been engaged in designing, developing and building steam generating equipment ever since.

Back of every Edge Moor installation of today there is the wealth of experience acquired through 67 years of boiler building—a cumulation of skills, methods and knowledge that enables Edge Moor to build boilers as outstanding in performance as were the Galloways in the days of the previous century.

Edge Moor boilers are designed for any required capacity and up to 900 lbs. drum pressure. Complete steam generating units, auxiliary equipment and installation service are available including boilers, superheaters, water walls, economizers and air preheaters. The combination of Edge Moor engineering experience and manufacturing control assures the ultimate in power plant performance.



Edge Moor bent tube boiler with pendant interbank superheater and travelling grate stoker. Capacity 47,500 lbs. steam per hour; Drum Pressure, 275 psi; Degrees of Superheat, 180° F.; Final Steam Temperature, 585° F.

STEAM GENERATING EQUIPMENT

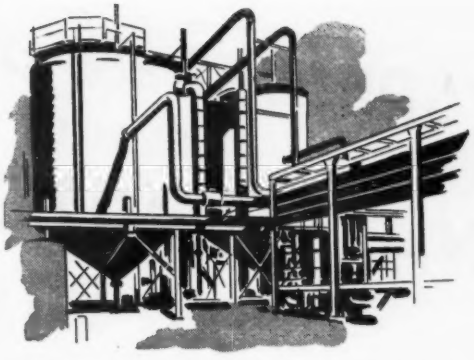
BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

EDGE MOOR
IRON WORKS, INC.

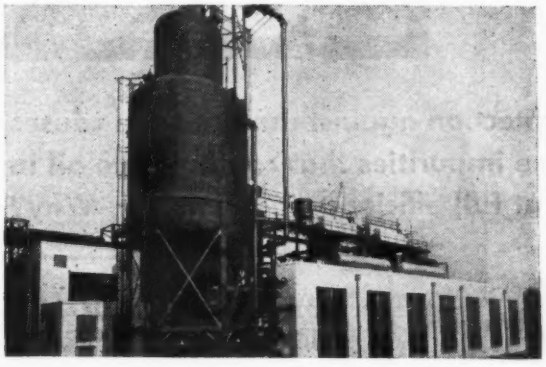
MAIN OFFICE AND WORKS: EDGE MOOR, DELAWARE

No scale or corrosion in boilers and steam lines

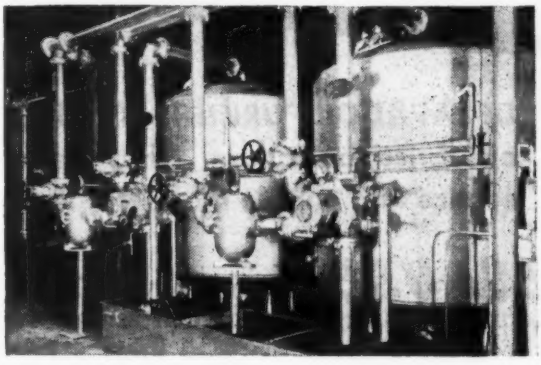
PERMUTIT-PROTECTED



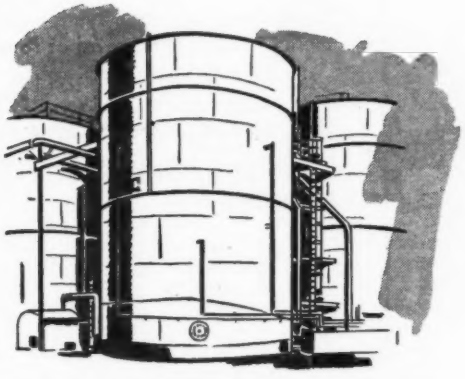
PERMUTIT HOT LIME SODA WATER SOFTENER Lime and soda ash precipitate bulk of water hardness as calcium carbonate and magnesium hydroxide. Sludge that forms is settled out and water is filtered. Integral heater simultaneously deaerates water.



PERMUTIT DEAERATING HEATER prevents corrosion, removes all oxygen and free CO_2 from feedwater. Designed for pressures up to 100 pounds or higher; capacities to 1,400,000 pounds per hour or higher. Utilizes bled or exhaust steam.



PERMUTIT ZEO-KARB* H removes both hardness and bicarbonate from water. Effluent contains no encrustants, is reduced in total solids. Alkalinity may be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.



PERMUTIT SILICA REMOVAL PROCESS reduces silica content to eliminate silica scale. Reagents used are low-cost, do not add soluble by-products. It can be adapted to existing equipment for hot or cold lime soda treatment or to Permutit's Demineralizers.

A type of water conditioning equipment to suit every need . . .

In thousands of war plants, Permutit* is on guard against boiler-scale and corrosion. World's largest manufacturer of water conditioning equipment, Permutit provides *every* process for controlling water quality.

In addition to the equipment described, Permutit products include Spaulding Precipitators, Degasifiers, Continuous Blowoff Equipment and Demineralizers that produce a low-cost substitute for evaporated water.

Today's heavy power output calls for full utilization of plant equipment. Let Permutit help *your* plant to keep up the good work! Write for information to The Permutit Company, Dept. A, 330 West 42nd Street, New York 18, N. Y.

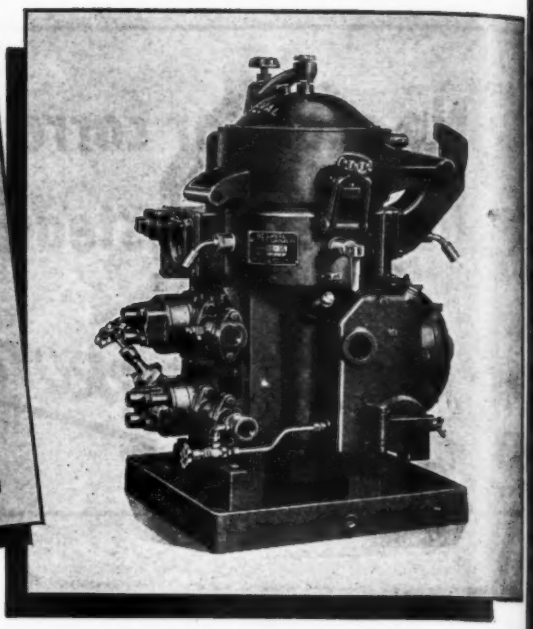
*Trademarks Reg. U. S. Pat. Off.

PERMUTIT

Serving industry and the armed forces . . . with GOOD WATER!

WATER CONDITIONING HEADQUARTERS

TURBINES and DIESELS ARE ONLY HALF PROTECTED UNLESS BOTH DIRT and WATER are REMOVED from the OIL



DE LAVAL OIL PURIFIERS **afford *full* protection against the principal causes of lubrication failure. They remove the impurities that contaminate oil in service and enable the oil to perform at full efficiency indefinitely. Why?**

BECAUSE - De Laval Oil Purifiers instantaneously remove by centrifugal force ***both*** of the chief enemies of good lubricating oil performance — ***water*** and ***dirt***. With a De Laval, there is no such thing as doing half the job — the protection to the prime mover is the maximum possible.

In the case of turbo-generating systems, the trouble-maker is usually sludge, and sludge forms fastest when water is present in the oil. De Lavals of proper capacity on continuous by-pass, purifying the oil in circulation three to four times daily, minimize sludge formation.

By removing water more completely from Diesel oil, the De Laval Oil Purifier helps prevent the formation of emulsions with the oil — a fact of especial importance when new heavy types of lubricating oil are used.

Protection from dirt is equally positive. Centrifugal force applied in the De Laval bowl removes any solid impurities more completely and quicker . . . keeps the oil clean and in "like new" condition.

ADVANTAGES OF DE LAVAL LUBRICATING OIL PURIFIERS

Maintain oil in condition most nearly identical with that of new oil

•

Provide maximum protection to power units

•

Constant high purifying efficiency—without renewal of functional parts

•

Remove both enemies of good lubricating oil performance: water and dirt

•

Economical to operate

•

Give long, trouble-free service

•

Lower maintenance costs

•

Self-draining purifier bowl makes for easy cleaning

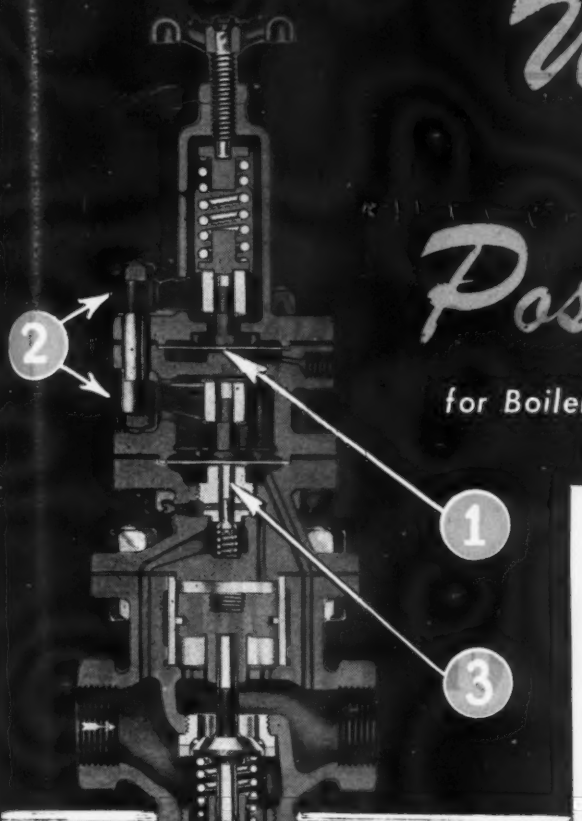
DE LAVAL LUBRICATING OIL PURIFIERS

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

Why LESLIE PUMP GOVERNORS Give Positive PRESSURE CONTROL

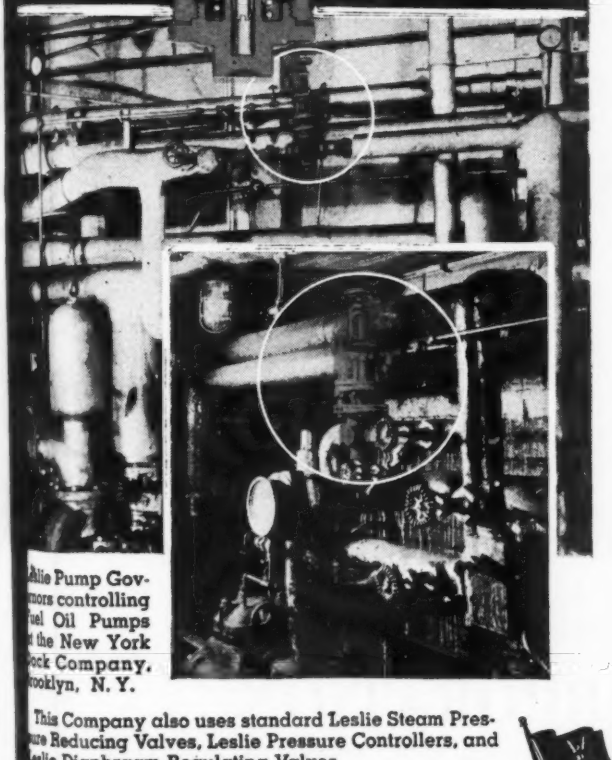
TRADE MARK REG. U. S. PAT. OFF.

for Boiler Feed, Fuel Oil and Fire Protection Pumps Reciprocating or Turbine Driven



MECHANICAL TRANSMISSION of the slightest change in pump discharge pressure exerted on the metallic diaphragm at this point (1) through yoke (2) to the lower steam diaphragm and controlling valve results in an instantaneous steam pressure change to the piston-operated main valve and to the pump.

A LARGE CORRECTING FORCE is created by even a small pump pressure variation by the positive action of the controlling valve (3) employing high inlet steam pressure and the piston-operated main valve. Total diaphragm travel is small and only .001" to .002" movement will vary steam chest pressure to pump sufficiently to maintain constant discharge pressure.



Leslie Pump Governors controlling Fuel Oil Pumps of the New York Dock Company, Brooklyn, N. Y.

This Company also uses standard Leslie Steam Pressure Reducing Valves, Leslie Pressure Controllers, and Leslie Diaphragm Regulating Valves.

THE operation of the Leslie Pump Governor is simple, smooth, and positive. The pump discharge pressure is easily adjusted or "set" by the convenient handwheel at the top, equipped with lock nut. After adjustment, the smallest variation in pump discharge pressure actuates the two diaphragms and the piston-operated main valve controlling the steam supply to the pump.

The Leslie Pump Governor thus automatically assures constant and positive pump discharge pressure during all load changes, and especially where fast, correcting action is required. Minimum maintenance, due to absence of stuffing boxes and bellows.

FEATURES OF THE LESLIE PUMP GOVERNOR

Self-contained. Single-seated. Monel Metal diaphragms (no bellows or packing glands). All wearing parts renewable without removing Governor from pipe line (100% interchangeability). The most corrosion and wear-resistant material obtainable (stainless steel hardened wearing parts and special heat resistant springs) is furnished as standard in all pump governors.

Improved production facilities assure prompt shipment—most items 10 to 30 days

FOR COMPLETE DATA BULLETIN 403A

LESLIE CO. • LYNDHURST • NEW JERSEY

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

●

30 years of research, development and operating experience throughout the world are incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

122 SOUTH MICHIGAN AVENUE
CHICAGO, ILL

Another Example of JOHNSON *Individual Room* CONTROL

Too warm! Windows thrown open! Result—fuel wasted! Naturally, some families want more or less heat than others. When each apartment dweller controls the temperature to suit his own needs, comfort is assured and fuel is saved. That is why a Johnson thermostat was installed in each of the 72 apartments in the Royal York when this exclusive building was built in 1938.

In keeping with finer living, Johnson Automatic Temperature Control for individual rooms offers the apartment dweller the comfort of a private home... Apartment owners and managers discover many direct and indirect benefits.

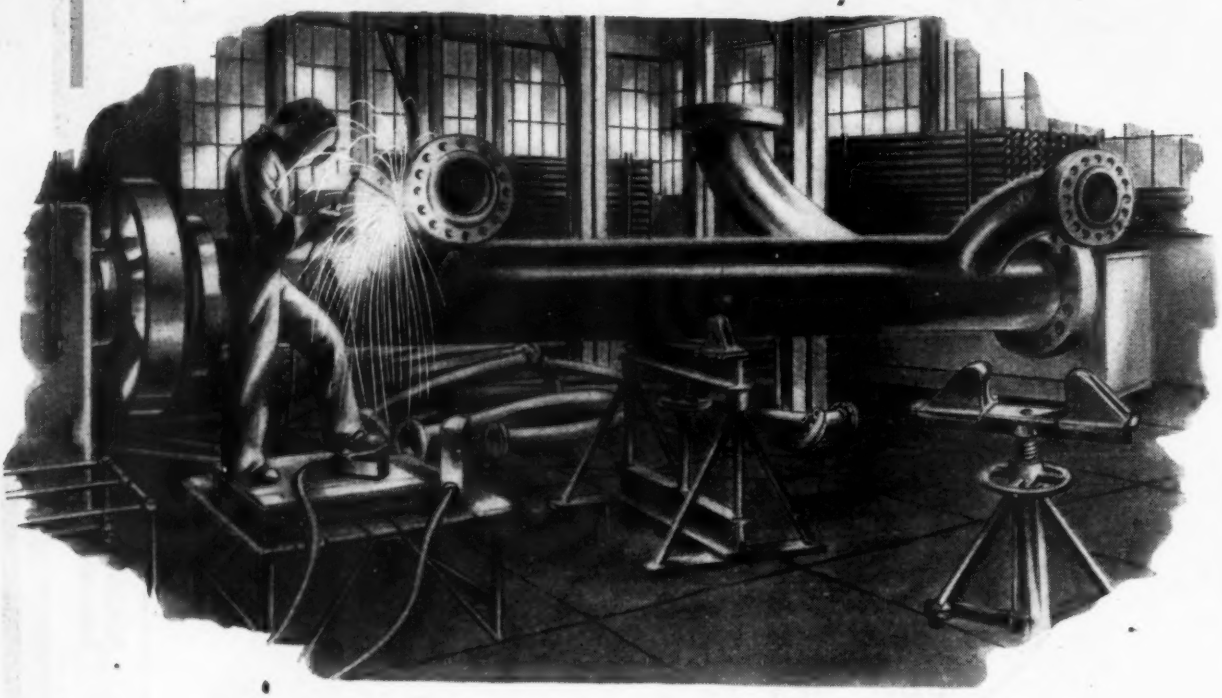
Years of experience with Johnson Room-by-Room Control clearly indicate that such facilities will be an important consideration in post war plans for buildings in which people live and work.

Johnson is nation-wide. Direct branch offices in principal cities afford practical cooperation in solving temperature control problems. Johnson designs, manufactures, installs and services with its own full-time personnel. Ask a Johnson engineer from a nearby branch office. There is no obligation, of course.

DESIGN
MANUFACTURE
INSTALLATION
SERVICE

JOHNSON
SERVICE COMPANY
MILWAUKEE 2, WISCONSIN
DIRECT BRANCHES IN ALL PRINCIPAL CITIES

SHOP WELDING of Pressure Piping has Important Advantages



Welding of pressure piping in the shop of a qualified pipe fabricator has many advantages which are difficult to duplicate in the field.

The great volume of pressure welding done in the plant of the fabricator gives *continuous* employment to large numbers of qualified welders—this day-after-day welding means that the hand never loses its skill. The welders are provided with a wide variety of work rotating fixtures for position welding under the most favorable conditions for both quality and production. Other facilities (usually superior in the shop) that have a direct bearing on the quality of welded piping include equipment for accurate layout, correcting alignment, stress relieving, cleaning and testing.

In the fabricating plant, it is much easier to exercise close and continuous supervision over all welders . . . to make certain that approved procedures are exactly followed in every detail.

Better welding is just one of the reasons why prefabricated piping by qualified fabricators is better piping.

THE PIPE FABRICATION INSTITUTE

1108 CLARK BUILDING, PITTSBURGH, PA.

DEVOTED TO THE TECHNICAL AND ECONOMIC PROBLEMS IN PIPING

G-4

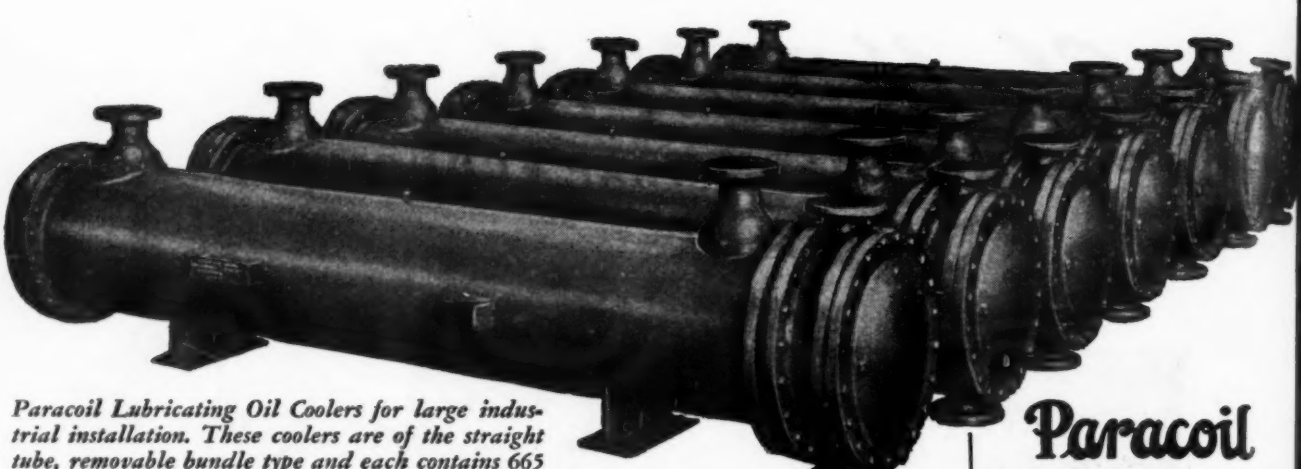
Chalk Talk No. 3

ON POSTWAR STEAM TRAP ECONOMY

Old style steam piping required the purchase of 7 or more fittings. . . . With this multiplicity of fittings is the cost of connecting them up. Not only are you required to purchase and install them but also each time a trap is inspected it has to be taken from the line and the installation cost is duplicated . . . Now, multiply these costs by the number of traps piped in the old style. Compare these costs with that of Super-Silvertop Steam Traps requiring only one fitting that can be inspected without removal from the line. This simplified piping for all sizes of steam traps was originated by Super-Silvertop. It has proved successful over years of actual use under a tremendous variety of uses. For true steam trap economy, specify and use Super-Silvertop Steam Traps. Write today for a copy of the book, "How to Choose a Steam Trap," giving complete details.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland 2, Ohio

Super-Silvertop
STEAM TRAPS



Paracoil Lubricating Oil Coolers for large industrial installation. These coolers are of the straight tube, removable bundle type and each contains 665 square feet of transfer surface with a capacity of cooling 500 GPM. Paracoil Coolers for lubricating Oils, Quenching Oils, Water and other liquids can now be furnished on quick delivery schedules. Inquiries are invited.

Plan Now...for Maximum
POSTWAR EFFICIENCY

TO eliminate any possibility of delay that other peacetime replacement demands may create, far-sighted plant officials have already started to check Heat Exchange equipment to determine that which may be obsolescent, depreciated beyond repair or insufficient in capacity for present or future loads. Equipment which has proved uneconomical or unsuited to present or contemplated operating conditions, and that which requires continuous costly servicing likewise indicates the necessity of carefully planned replacement.

Orders for the units listed in column at right can now be filled on reasonable delivery schedules, if accompanied by suitable priorities. Davis engineers will help you to prepare for maximum peacetime efficiency in selection of Heat Exchange Equipment. We will be pleased to submit recommendations or proposals on your particular heat transfer problems or requirements.

Paracoil

These Paracoil products will fill many of your replacement or new equipment needs.

EVAPORATORS
For boiler water make-up.

DISTILLATION PLANTS
To supply distilled water for process.

FUEL OIL HEATERS
For service-free operation.

CLOSED FEED WATER HEATERS
For higher temperatures.

WASTE HEAT BOILERS
For heat recovery from diesel engine exhaust.

BLOW DOWN HEAT EXCHANGERS
For recovery of heat from boiler blow down.

CONDENSATION COOLERS AND PREHEATERS
For recovery of heat from waste liquids.

CONDENSERS
For recovery of vapors.

WATER HEATERS AND MISCELLANEOUS HEAT EXCHANGERS
For process heating or cooling.

SINCE 1915
Paracoil
HEAT TRANSFER EQUIPMENT

DAVIS ENGINEERING CORPORATION
1066 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY

Gilmer V-BELTS

Designed for hard service and maximum power

WHEREVER Gilmer V-Belts are used, you can count on them for tight grip, ample strength, minimum stretch, flexibility, and resistance to wear—the five major factors that assure dependable performance, maximum power, and economy.

A tight grip is assured by the straight sides of Gilmer V-Belts, which bulge outward as they flex around the sheaves, yet unlock freely and instantly when pressure is released.

Extra tough pulling cords, riding in parallel, and bonded by a special Gilmer compound to maintain alignment, provide adequate strength for any power drive.

The Gilmer process of precision moulding assures minimum stretch and "matched" lengths within very small tolerances. Being highly flexible, the belts operate smoothly at high speeds on small diameter sheaves and short center drives. Extra tough, heavy jackets enable them to stand up long in hard, continued service.

Gilmer has the largest assortment of V-moulds in the world. Belts are supplied in FHP and multiple, endless and non-endless, standard and special.

Write for a FREE copy of the Gilmer Guide, the most complete V-Belt catalog in the field. It contains valuable engineering information, standard sheave and belt tables, and other useful data.

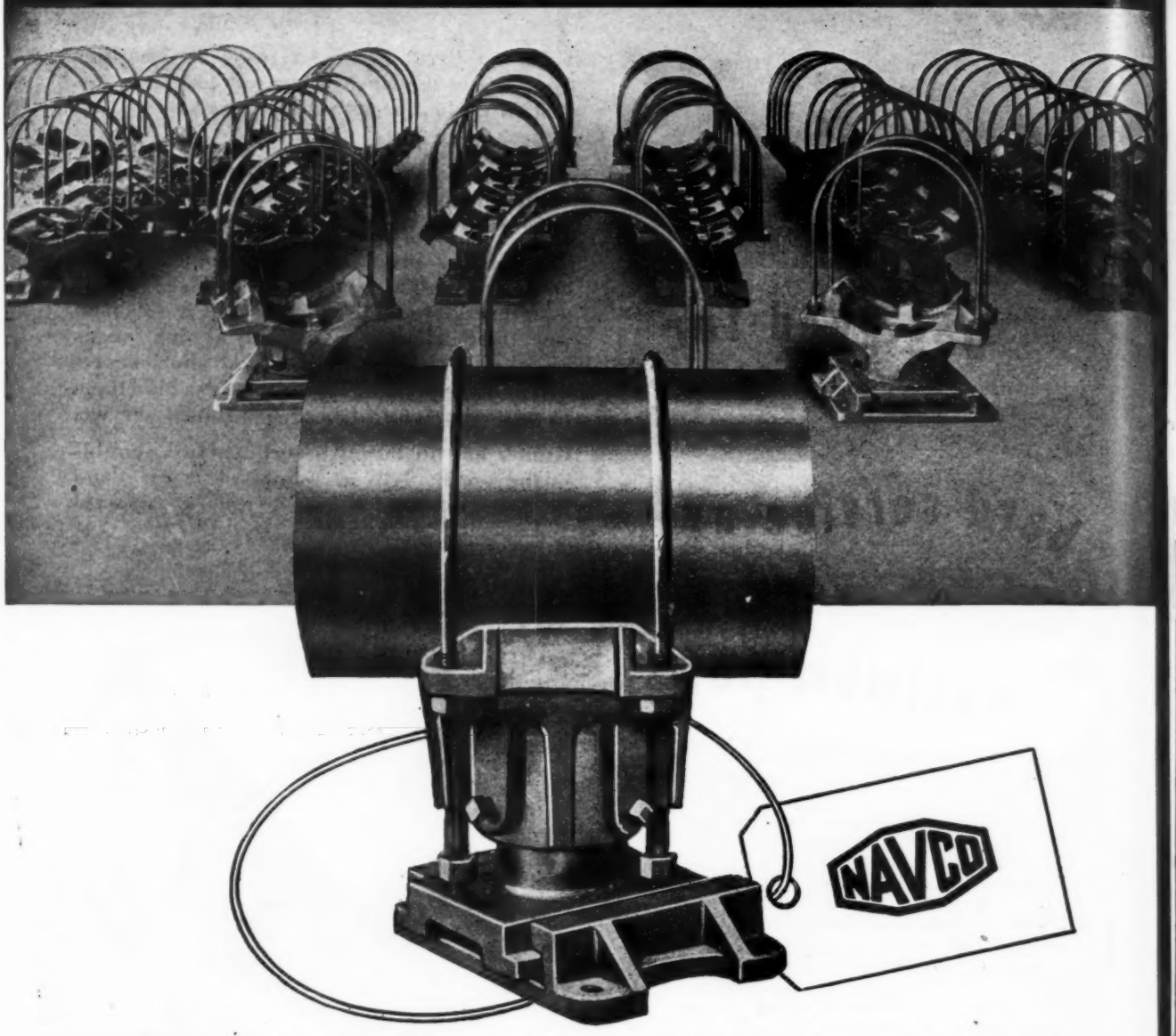
Gilmer makes a complete line of belts and belting for every power transmission need.

Gilmer BELTS

L. H. GILMER COMPANY, Tacony, Philadelphia 35, Pa.

DIVISION OF UNITED STATES RUBBER COMPANY

NAVCO "UNIVERSAL" PIPE SUPPORTS



Navco Universal Support will take care of eight inches of expansion and can be made special to accommodate any amount of travel.

Vertical adjustment up to 2½ inches can be made.

Support may be turned to any angle of 360°.

Holds pipe down as well as up. Prevents pipe from getting out of alignment, which is usual in the Roller Type of support.

It permits control of expansion movement of pipe and insures the desired free action of Slip Expansion Joints so essential in tunnel and duct work.

Carrier is fixed to a predetermined point on the pipe, thereby eliminating possibility of destroying insulation. There is a recess in the saddle for insulation and the entire support can be insulated on the outside.

Navco Universal Pipe Supports are made of cast iron but can also be furnished in steel at increased prices. For installations exposed to the weather, bases can be furnished with brass liners or provided with forced lubrication.

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA

Even the largest size...

takes less than 28 sq. ft. of floor space

including the motor

- heavy duty
- trouble-free
- precision-built
- quiet and compact

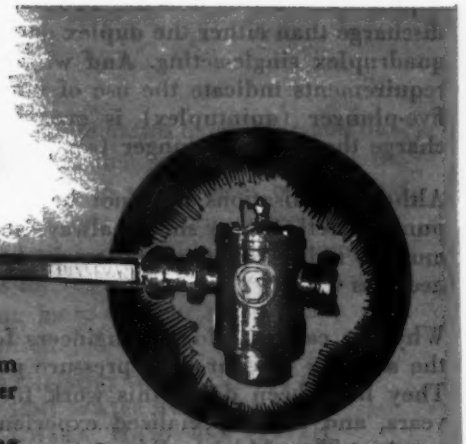
Another Modern Compressor Design Pioneered By Sullivan

other products

Stationary and Portable Air Compressors from ¼ to 3000 H.P., Pneumatic Casting Grips, Foundation Breakers, Portable Hoists, Rock Drills.

THE MODERN DESIGN of Sullivan WG-9 air compressors gives them greater capacity per square foot of floor space — as much as 43 C.F.M. per square foot on 100-lb. rated machines.

Sullivan WG Series Compressors are heavy duty, single-stage, double-acting units that are specially designed for continuous service where volume requirements are moderate. Long, trouble-free operation is assured by full force-feed lubrication to all working parts . . . replaceable cylinder liners and crosshead guides, and anti-friction main bearings. Because of their compactness and simple block type foundations, they can be installed quickly, easily and economically right where the air is needed. Available in eleven sizes with displacements from 153 to 822 C.F.M. at pressures from 30 to 150 lbs. Bulletin A-43 will give you complete details. **Sullivan Machinery Company, Michigan City, Indiana. In Canada: Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.**



Complete your compressed air plant with a Sullivan Aftercooler. Sullivan Aftercoolers remove water vapor and entrained oil from compressed air by effectively condensing the vapor and isolating the condensate and oil before they enter the distribution lines. Because they deliver cool, dry and clean air they quickly pay for themselves.

air compressors from ¼ to 3000 h.p.

SULLIVAN

OFFICES { Birmingham • Boston • Butte • Chicago • Claremont • Dallas • Denver • Duluth • El Paso
Huntington • Knoxville • Los Angeles • Middlesboro • New York • Philadelphia • Pittsburgh
Portland • Salt Lake City • San Francisco • Seattle • Spokane • St. Louis • Washington, D. C.

What about the NUMBER of PLUNGERS in a HIGH PRESSURE PUMP?

In selecting a reciprocating high-pressure pump, careful consideration is needed to determine the most suitable number of plungers for the specific service involved. Generally speaking, for a given capacity, the fewer the plungers—the lower the first cost. However, variations above and below the mean discharge rate must be considered if undesirable pulsations are to be guarded against.

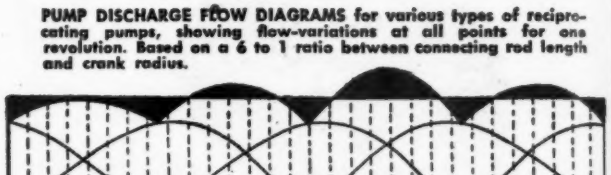
The accompanying pump discharge flow diagrams show that pulsations are *not always reduced* by increasing the number of cylinders. For example, the triplex single-acting unit has a considerably smoother discharge than either the duplex double-acting or the quadruplex single-acting. And where large capacity requirements indicate the use of more plungers, the five-plunger (quintuplex) is even *smoother* in discharge than the six-plunger (sextuplex).

Although pulsations may not be a major factor in pump selection, they should always be held to a minimum to reduce noise, vibration, hydraulic shock and needless wear.

Why not call on Aldrich engineers for assistance in the solution of your high pressure pump problems? They have been doing this work for more than 40 years, and their specialized experience is available to you. The Aldrich Pump Company, Allentown, Pennsylvania.

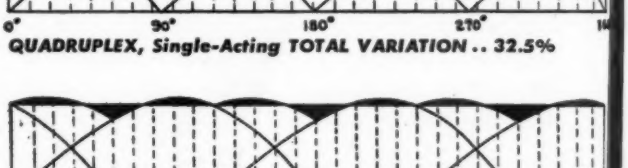
REPRESENTATIVES: Birmingham • Bolivar, N. Y. Boston • Chicago • Cincinnati • Cleveland • Denver Detroit • Duluth • Houston • Los Angeles • Pittsburgh Portland, Ore. • St. Louis • San Francisco • Seattle Tulsa

PUMP DISCHARGE FLOW DIAGRAMS for various types of reciprocating pumps, showing flow-variations at all points for one revolution. Based on a 6 to 1 ratio between connecting rod length and crank radius.

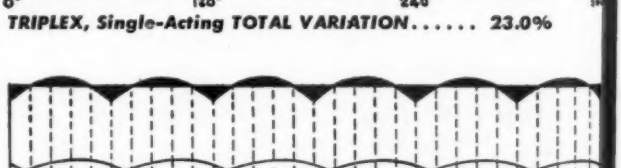


DUPLEX, Double-Acting TOTAL VARIATION.... 45.6%

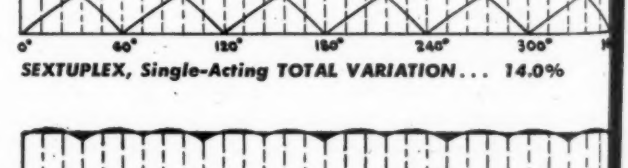
QUADRUPLEX, Single-Acting TOTAL VARIATION.. 32.5%



TRIPLEX, Single-Acting TOTAL VARIATION..... 23.0%



SEXTUPLEX, Single-Acting TOTAL VARIATION... 14.0%

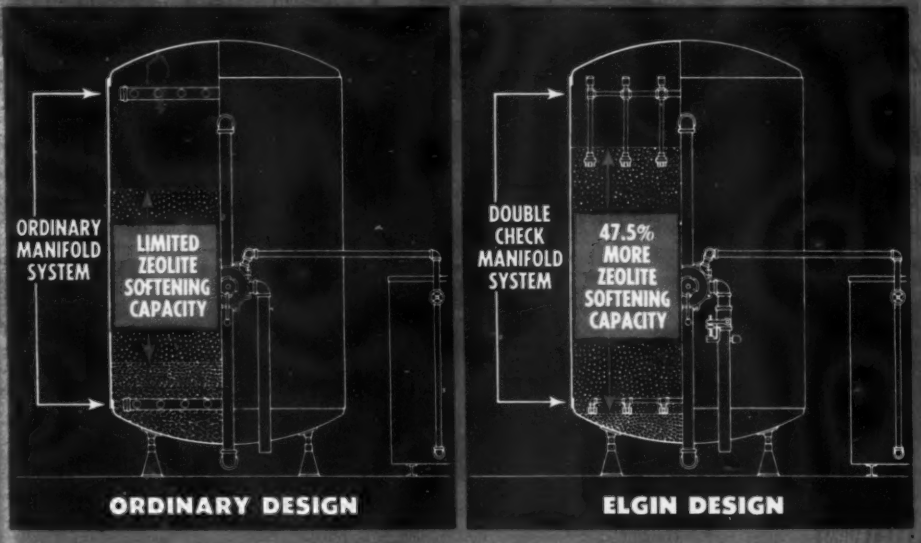


QUINTUPLEX, Single-Acting TOTAL VARIATION...7.0%

ALDRICH ... anticipates industry's pumping needs

ELGIN WATER SOFTENER

gives 12,600 gallons more soft water



ELGIN FEATURES

- *Delivers up to 50% more soft water*
- *Prevents loss of zeolite*
- *Requires less salt*
- *Assures better backwashing*
- *Costs less per thousand gallons*

HERE is a typical example of Elgin performance. The two water softeners diagrammed above are identical in size (36″ x 72″). Each uses synthetic zeolite to soften ten-grain water. In actual performance, the Ordinary Design softens only 26,500 gallons of water per regeneration, while the Elgin Design softens 39,100 gallons of water per regeneration. Think of it—12,600 gallons or 47.5% more soft water with the Elgin!

The reason for this remarkable increase in soft water output is shown in the illustrations above. Note the far greater zeolite content of the Elgin — made possible by an ingenious "Double-Check" manifold system. This design makes the deeper bed possible without loss of zeolite—a loss that the ordinary water softener attempts to avoid during backwashing by using a shallow zeolite bed, as illustrated.

Of course, more zeolite means more soft water output, for it's the zeolite that softens water. But the "Double-Check" manifold system goes beyond that . . . prevents zeolite loss . . . permits zeolite to be washed cleaner . . . prevents packing and channeling of the bed. Thus the brine reaches every granule of zeolite, producing more efficient regeneration with less salt consumption.

INCREASE THE SOFT WATER OUTPUT OF YOUR PRESENT WATER SOFTENER WITH "DOUBLE-CHECK" MANIFOLD SYSTEM

The "Double-Check" manifold system can be quickly installed in water softeners of any make. This change supplemented by remarkable high capacity ELGIN ZEOLITE *when required will greatly increase soft water output and operating efficiency. The cost of such modernization is surprisingly low.*

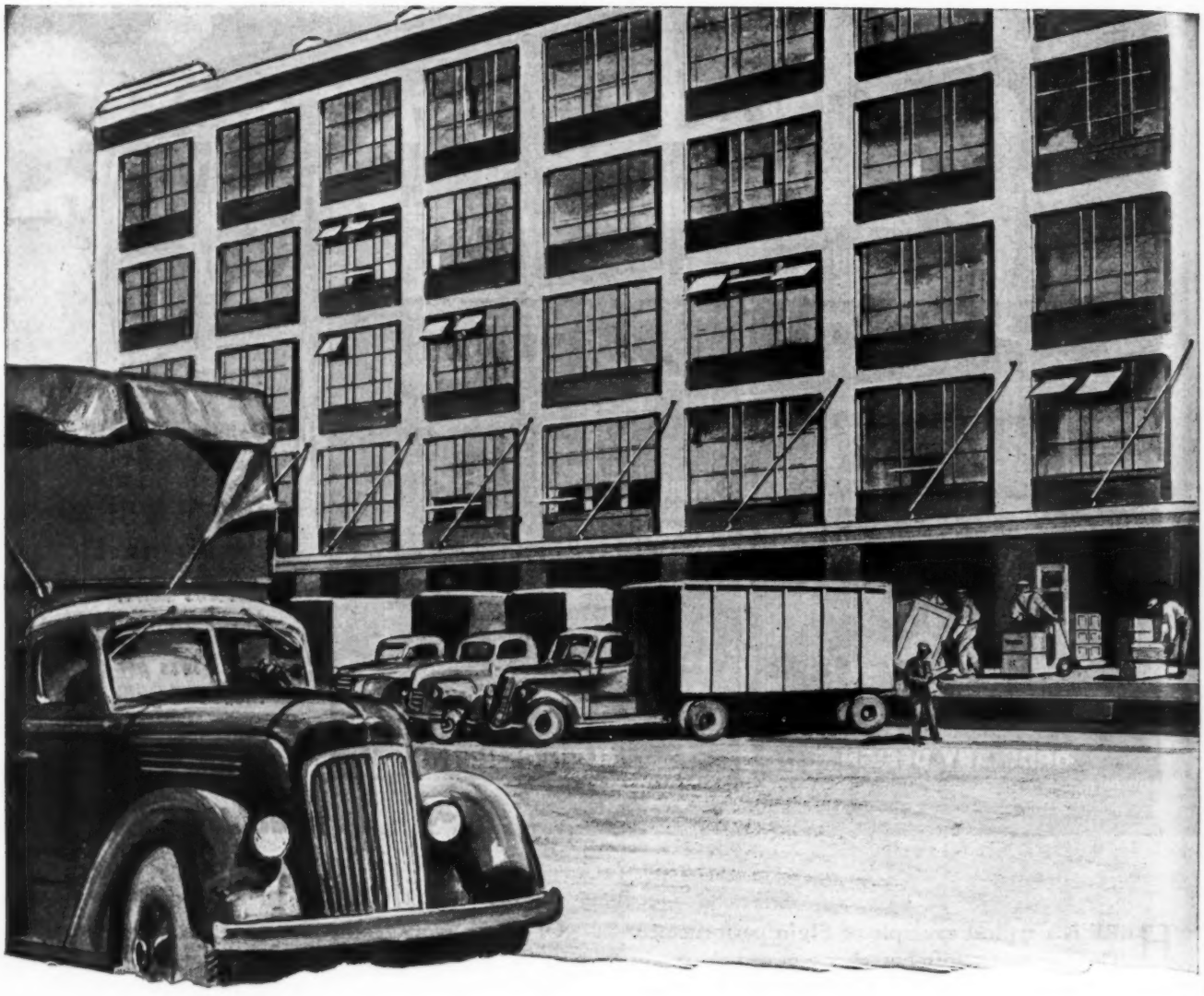
For facts about the Elgin Water Softener or modernization of your present water softener, write for Bulletin 603.

ELGIN SOFTENER CORPORATION, 130 N. Grove Ave., Elgin, Ill.

ELGIN
ECONOMICAL WATER CONDITIONING

WATER CONDITIONING FOR EVERY NEED

Elgin is known for achieving results at lowest possible cost. The complete Elgin line includes: Boiler Water Treating and Purifying Systems • Feedwater Treatment • Deconcentrators • Water Softeners • Filters and Purifiers • Iron Removal Equipment • Aerators • Water Treating Chemicals • Chemical Feeders • Scale and Corrosion Inhibitors • Sample Coolers • Water Testing Equipment • Zeolites



Why FREIGHT ELEVATORS are important!

BEHIND this busy scene, freight elevators are constantly on the job . . . keeping supplies and even the trucks themselves moving on schedule . . . without bottlenecks . . . without confusion.

For intensive service, the elevators should be high speed, automatic in operation and provided with power operated doors. Such equipment will compensate for some of the time lost in loading and unloading operations.

If conditions require, freight elevators can be dispatched to predetermined floors to suit any cycle of operation. Also, they do not necessarily require regular attendants.

Your nearest Otis representative is now available to assist you and your Architect in making preliminary elevator plans and studies. For the finest in vertical transportation tomorrow, call your Otis representative TODAY!

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

Medart SS Type Pillow Block equipped with Timken Tapered Roller Bearings mounted on adjustable base.

A tremendous volume of power has been — and is being — wasted through obsolete mechanical transmission equipment; burned up by friction before it reaches the point of application.

Every unit of power lost means an increase in power cost. In addition an excessive amount of lubricant is required together with many extra man-hours to apply it. There is, furthermore, an ever-present danger of product damage or contamination through lubricant leakage. Maintenance is high because, among other things, rapid shaft wear is prevalent.

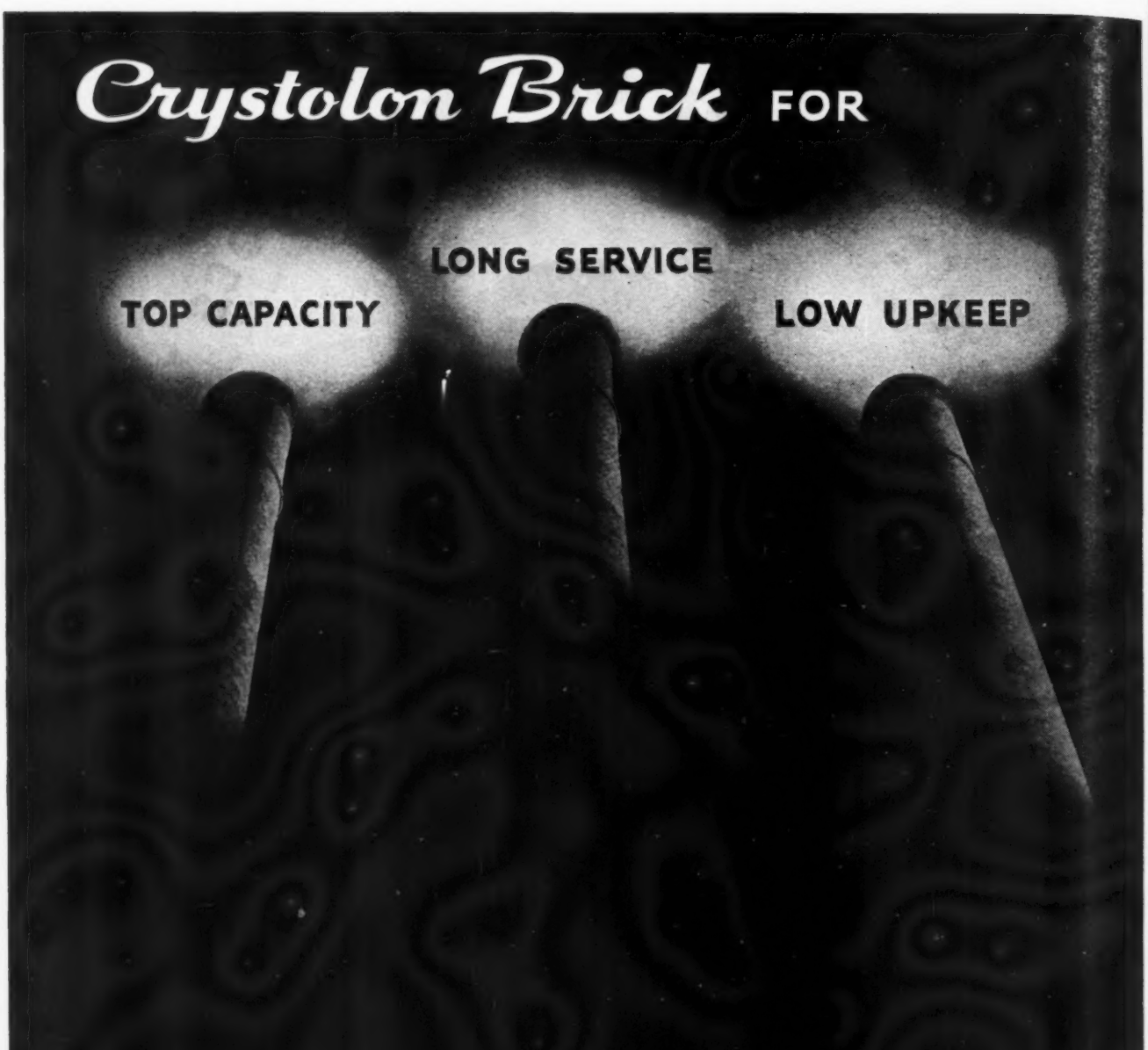
Add to all this the constant threat of unscheduled work stoppages through power interruptions resulting from transmission failures and you have a strong case in favor of replacing your obsolete, worn-out, plain bearing transmission equipment with modern Timken Bearing Equipped units *now*. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Crystolon Brick FOR



CRYSTOLON Brick by Norton will give long, economical service at top capacity and will reduce maintenance time and expense when used at the clinker line of coal-fired boiler furnaces, in the bridge wall and front wall. These highly refractory silicon carbide brick have great resistance to abrasion, to spalling and to the chemical and physical action of molten slag. Slag may adhere to the brick to a very limited degree, but it is easily removed without harming the surface of the wall.

NORTON COMPANY - Worcester 6, Mass.

Norton Longer Lasting **Refractories**

EVEN THE *Worrybird* CAN'T WORRY ABOUT THIS MOTOR

Can't worry about premature breakdown.

The Crocker-Wheeler Protected-Type Motor is built to last. Frame and shields have no openings above the horizontal center line, which means that dripping liquid and falling metal chips won't get in to damage the interior working parts. Vinylastic insulation makes coils dirt, oil, and moisture resistant to a high degree. Phase insulation provides added protection. Dynamically balanced, ALUCAST rotor is practically indestructible.

Can't worry about maintenance.

Patented bearing seal for ball bearings (sleeve bearings are optional) is so effective that re-greasing is required only once a year or even less frequently. This seal permits use of softer grease for better lubrication and longer bearing life.

Can't worry about first cost.

Despite all these advantages, Protected-Type Motors cost no more than conventional open types. They combine added protection with the surplus capacity (40C rise with a 15% service factor) of the open motor.

Why not investigate the many advantages of this new motor—to see if you can't end your own worries? Send for your FREE copy of descriptive bulletin, DL-121, that shows how these motors are protected, where they should be used, why they will give long trouble-free service. Write today—no obligation.

CW-1

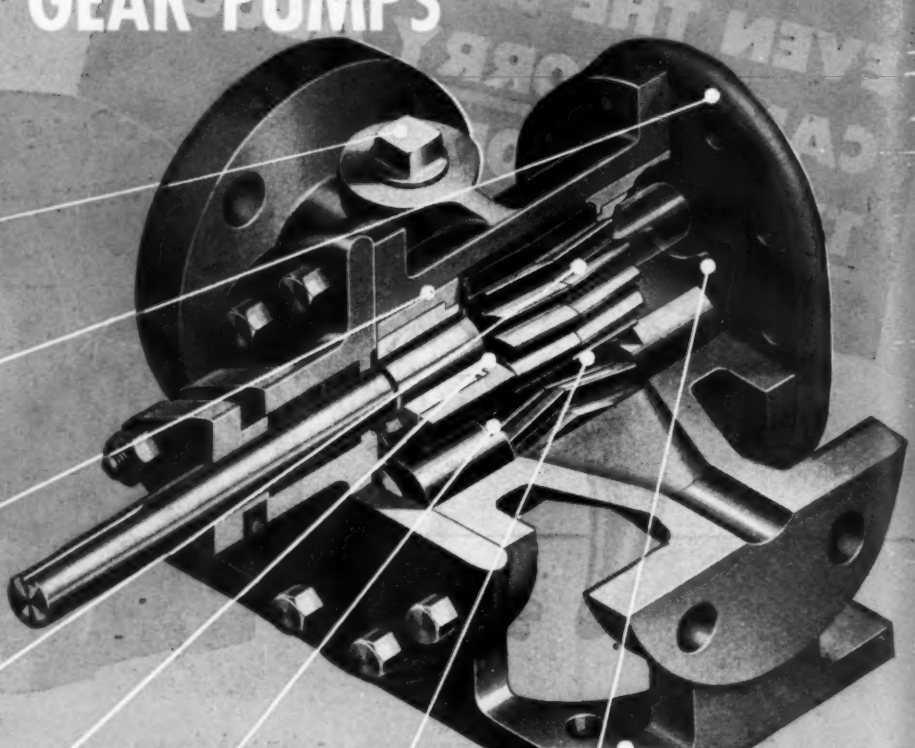
CROCKER-WHEELER

A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

SQUIRREL CAGE MOTORS | WOUND ROTOR MOTORS | DIRECT CURRENT MOTORS | GENERATORS | FLEXIBLE COUPLINGS

FOR *Tough* PUMPING OPERATIONS SPECIFY SK GEAR PUMPS



Pipe Taps Permit By-Passing of Full Pump Capacity

No Dowel Pins

Straight Bore Housing Eliminates Bearing Overhang

Case-Hardened Gears Are Press-Fitted and Keyed to Prevent Lateral or Radial Motion

Rotor and Bearing Assembly Removable as a Unit

Relief Pockets Eliminate Liquid Trapping

Special High Pressure Tooth Angle Prevents Excessive Slippage

Pressure on Stuffing Box is Dissipated Through Channel in Cover Plates

Integrated Casting Provides Rigid Housing

Experience has proven smooth performance, high efficiency, low maintenance and long life of SK Gear Pumps in handling capacities up to 1000 gpm and pressure up to 3500 psi. For detailed information, write for Bulletin 17A.

SCHUTTE & KOERTING CO. *Manufacturing Engineers*

1150 THOMPSON STREET, PHILADELPHIA 22, PA.

JET APPARATUS • CONDENSERS AND VACUUM PUMPS • HEAT TRANSFER EQUIPMENT • VALVES • ROTAMETERS AND FLOW INDICATORS • GEAR PUMPS • STRAINERS • OIL BURNING EQUIPMENT • SPRAY NOZZLES AND ATOMIZERS • RADIAFIN TUBES

Ring Controlled

"PACKLESS"

EXPANSION JOINTS

This hurts Dad a lot more than it does Johnnie, who has taken the simple precaution of inserting a bit of padding where it does the most good.

Similarly, your pipe line can stand a lot of punishment if you take proper steps to offset the stresses and strains of expansion due to variance in temperature, pressure, vibration, or axial movement. Ring Controlled Expansion Joints as made by the Badger Fire Extinguisher Company are designed to compensate for all the forces that tend to disrupt a pipe line. They are available in single or multiple corrugations, in flange or weld type for steam, air, liquid, or gas lines.

PROCESSED IN COPPER, STAINLESS STEEL OR OTHER ALLOYS

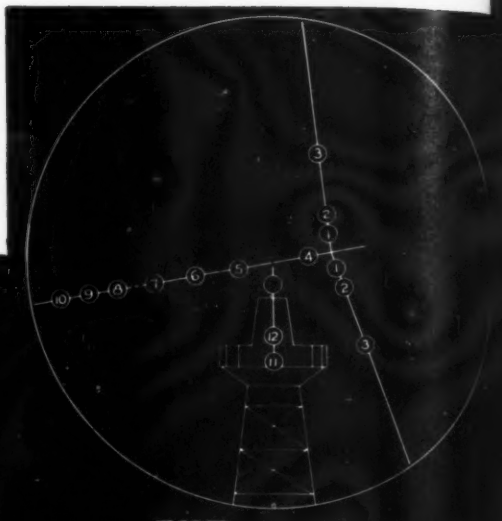
Catalog on request

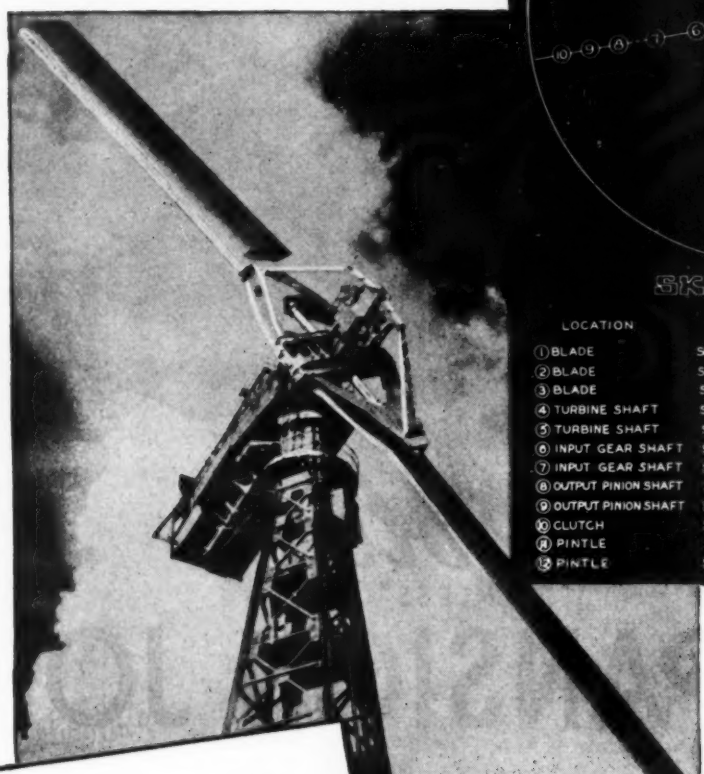
BADGER FIRE EXTINGUISHER COMPANY *Somerville 43, Mass.*

HARNESSING the wind

to light 2,000 homes

WITH SKF REDUCING FRICTION TO A VANISHING POINT





● *Built under the financial sponsorship of S. Morgan Smith Co. to the designs of Palmer Coslett Putnam, Boston engineer and inventor, this Smith-Putnam Wind Turbine, world's largest windmill perched on top a 110-ft. steel tower on 2,000 ft. Grandpa's Knob, Vt., is designed to feed 1,000 kw. into the power lines of the Central Vermont Public Service Corp. – enough electricity to light five 100-watt lamps for each of 2,000 families.*

SKF BEARINGS

LOCATION	BEARING TYPE	BEARING DIMENSIONS BORE	O. D.	WIDTH
① BLADE	SPHER. ROLLER THRUST	14.500"	24.000"	6.750
② BLADE	SPHERICAL ROLLER	11.8110"	19.6850"	6.2992
③ BLADE	SPHERICAL ROLLER	20.8661"	34.2520"	10.7087
④ TURBINE SHAFT	SPHERICAL ROLLER	24.8031"	40.5512"	12.4016
⑤ TURBINE SHAFT	SPHERICAL ROLLER	18.1102"	32.0772"	11.6535
⑥ INPUT GEAR SHAFT	SPHERICAL ROLLER	14.1732"	21.2598"	5.2756
⑦ INPUT GEAR SHAFT	SPHERICAL ROLLER	10.2362"	15.7480"	4.0945
⑧ OUTPUT PINION SHAFT	SPHERICAL ROLLER	6.6929"	12.2047"	3.3858
⑨ OUTPUT PINION SHAFT	SPHERICAL ROLLER	6.6929"	12.2047"	3.3858
⑩ CLUTCH	SINGLE ROW BALL	6.2992"	11.4173"	1.8898
Ⓐ PINTLE	SPHERICAL ROLLER	11.8110"	19.6850"	6.2992
⑫ PINTLE	SPHER. ROLLER THRUST	14.500"	24.000"	6.750

● *The SKF Spherical Roller Thrust Bearing (see No. 1 in diagram) absorbs a maximum thrust load of 1,039,390 lbs.*

When these two 65-ft. streamlined, stainless steel blades spin at a tip speed of 180 miles per hour, punishing loads are imposed upon SKF Bearings. Thrust loads climb to more than 1,000,000 lbs. —radial loads to almost as much—but there are more than 50 SKF's with bores ranging from 1⅜" to 24⅛" to meet them. For bearings that convert maximum *wind* power into *paying* power . . . that provide an equalized load distribution insuring full bearing capacity and long life, men who do things never done before invariably use SKF's.

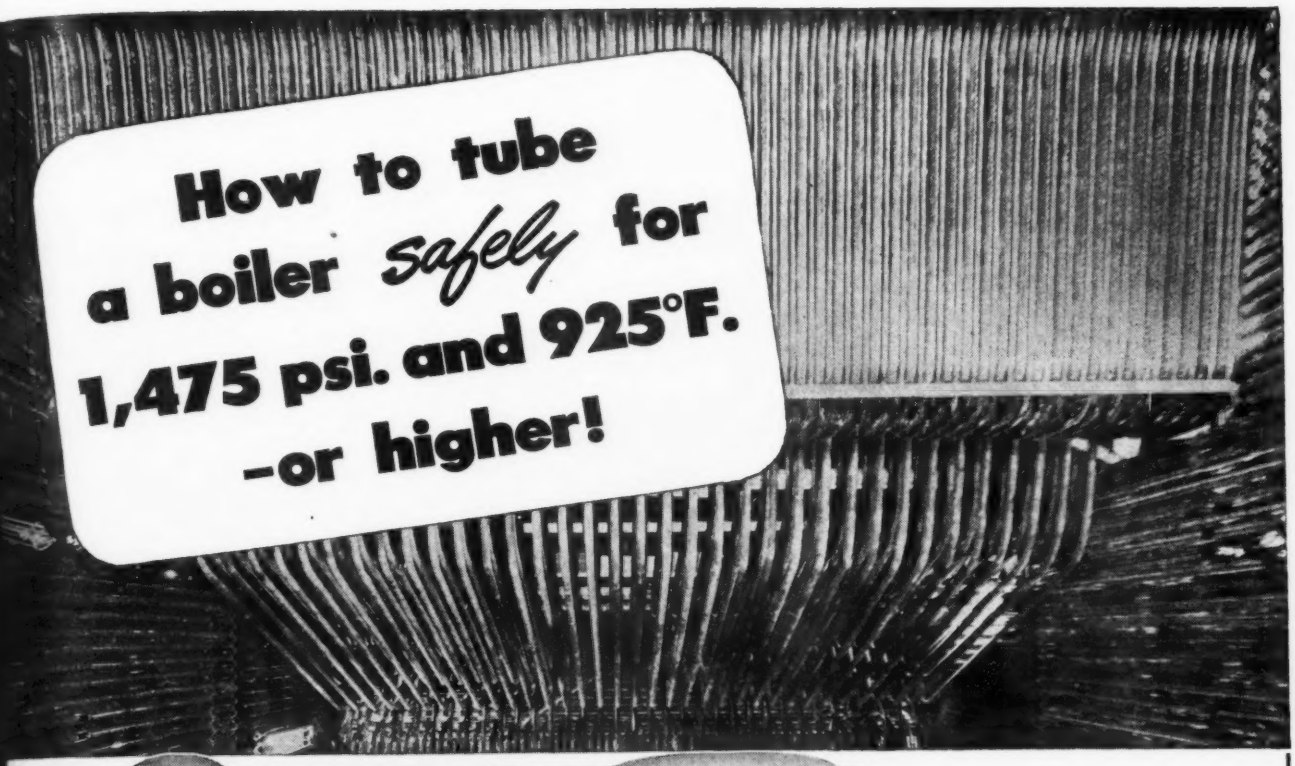
5816

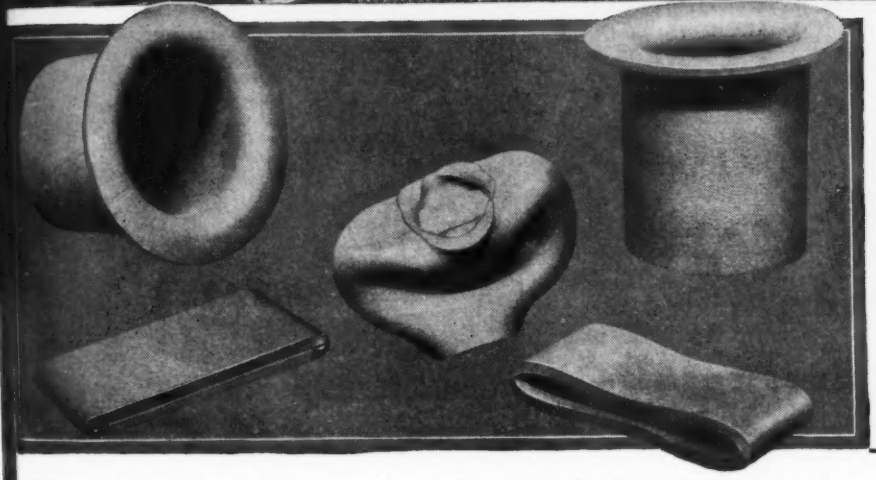
SKF INDUSTRIES INC., PHILA. 34, PA.

SKF

BALL AND ROLLER BEARINGS

How to tube a boiler *safely* for 1,475 psi. and 925°F. —or higher!





LOOKING UP from the floor of this high-pressure, high-temperature boiler you see hundreds of boiler tubes—all NATIONAL Seamless—all one uniform quality.

CRUSHING, FLATTENING, *and flanging* tests showing good manipulating properties.

THE boiler shown above generates 615,000 lb. of steam per hour at 1,475 psi. and 925°F. While such pressures and temperatures are high, there are many boilers in existence that go even higher.

To meet these conditions, engineers and metallurgists at NATIONAL Tube Company have developed alloy boiler tubes so heat treated or annealed as to retain both maximum strength at high temperatures, and all the good manipulating properties at room temperature, which are necessary for expanding, rolling, and beading. This combination reaches its highest development only in a seamless tube. The same inherent characteristics make seamless easily the top material for power piping.

In fact, in many cases involving severe or hazardous service, the use of seamless pipe and tubing is mandatory. "Walls Without Welds"—pierced from solid steel—means absolutely uniform wall strength — no longitudinal line of potential weakness.

And for leadership in seamless, look to NATIONAL—the world's largest manufacturer of tubular products with widest experience, most complete facilities, the best "know how."

NATIONAL TUBE COMPANY

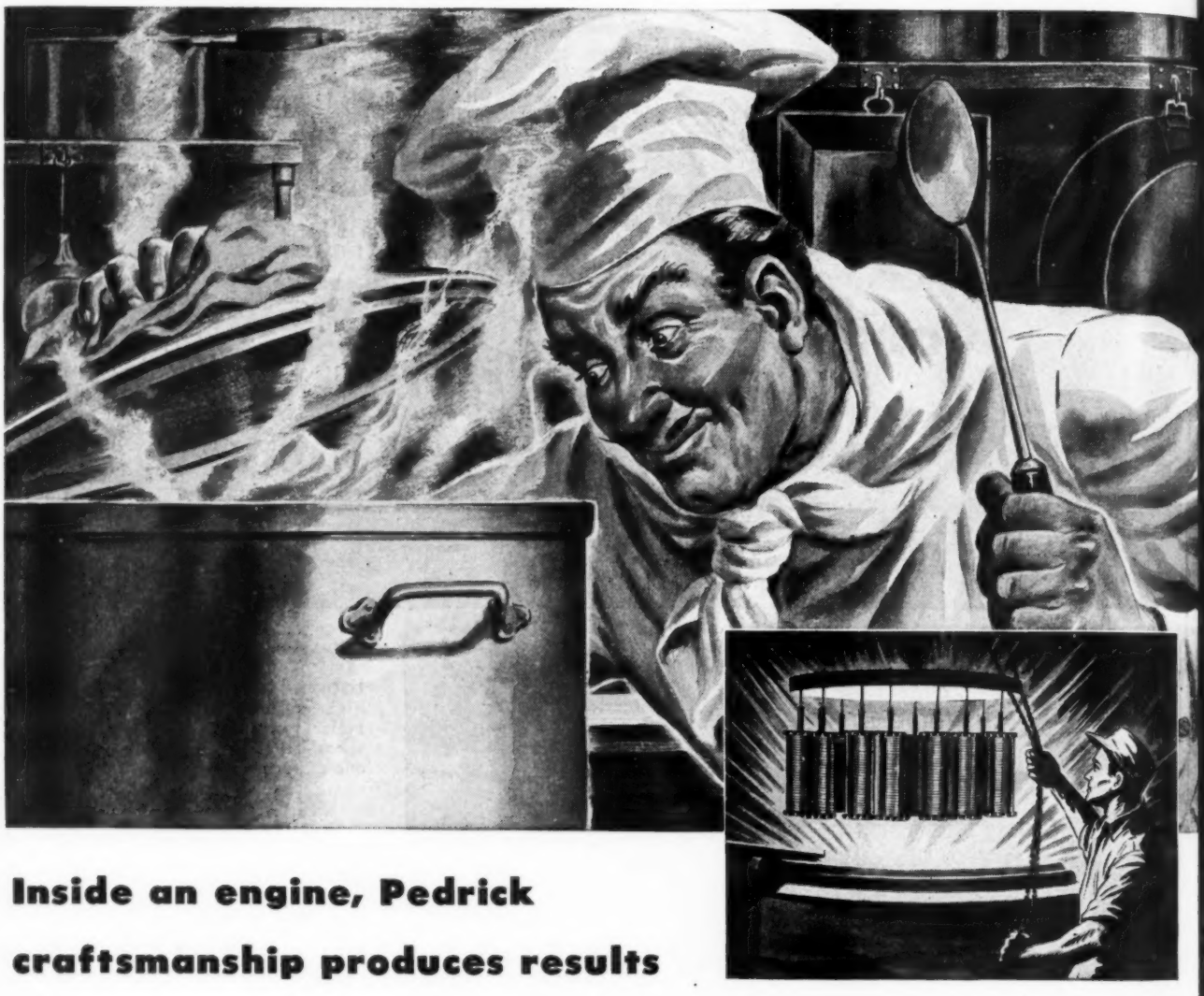
PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

It's what goes on **INSIDE** *that count*



Inside an engine, Pedrick craftsmanship produces results

ALL THE THINGS that go to make up fine ring performance are properly blended into Pedrick rings. Long years of production experience in developing means of holding tolerances and tensions . . . constant field checking to be sure of results . . . advance designing to keep abreast of modern developments—all these are part of the Pedrick recipe that enables Pedrick craftsmen to produce outstanding rings.

Heat-Shaping is a typical Pedrick development that sets exactly the right amount of tension in a ring, properly distributed around its entire circumference. This exclusive process removes the stresses and strains of machining operations and greatly contributes to the long-life efficiency of the ring.

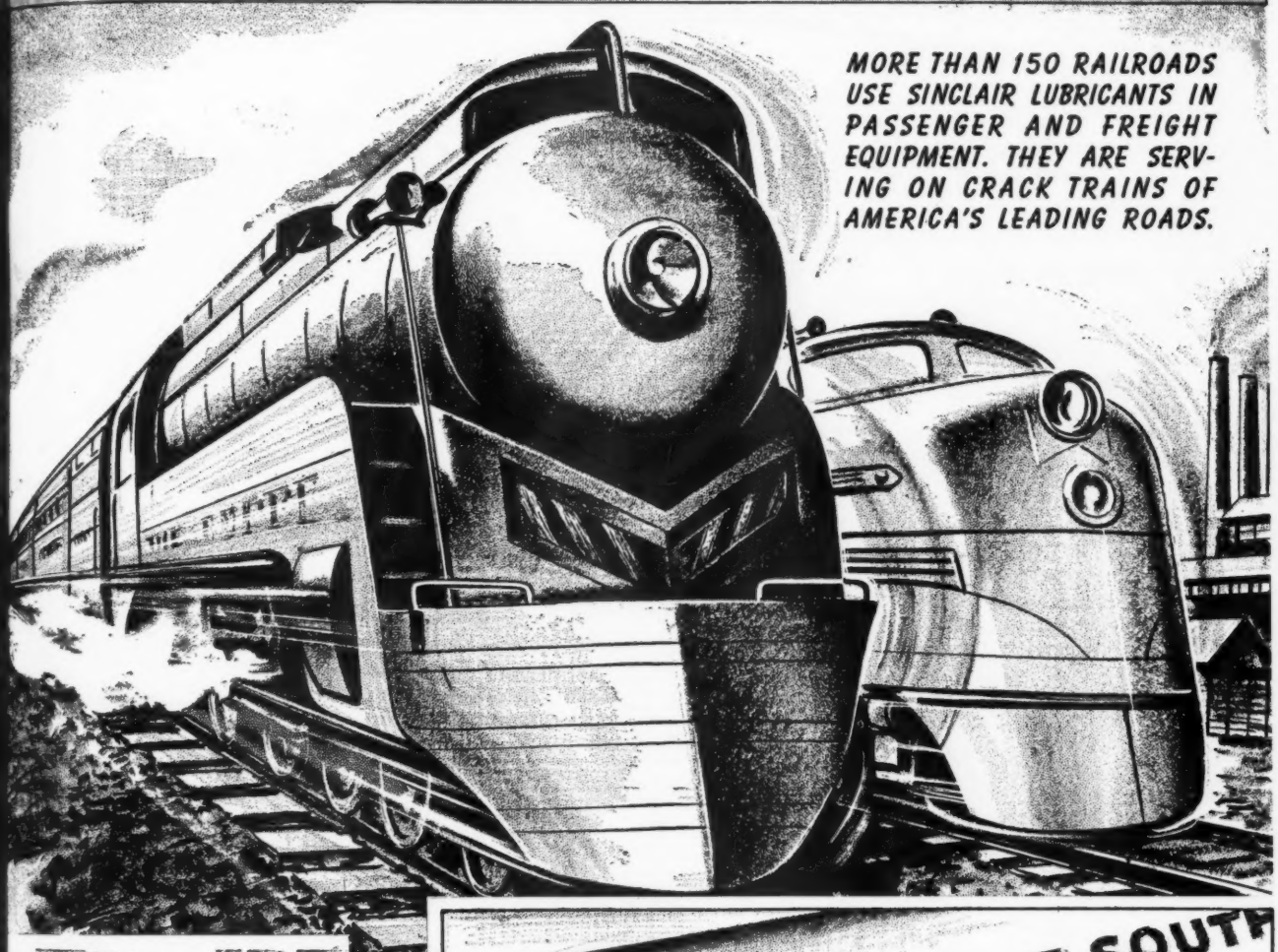
If you have a taste for fuel savings . . . for longer time between overhauls . . . for increasing the life span of your equipment, recondition your Diesels with Pedrick piston rings. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

Pedrick

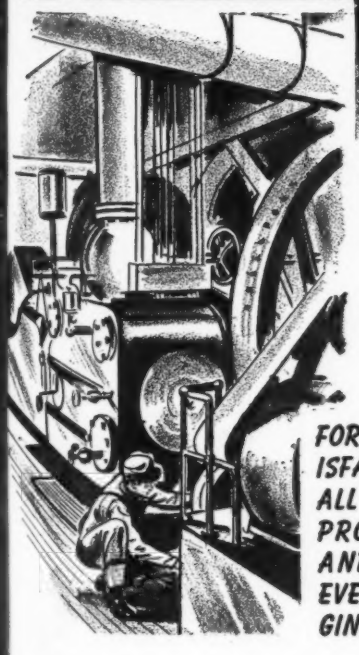
precisioneered **PISTON RINGS**

FOR THE PRESENT, BUY MORE BONDS FOR YOUR FUTURE

Do you know that . . .



MORE THAN 150 RAILROADS USE SINCLAIR LUBRICANTS IN PASSENGER AND FREIGHT EQUIPMENT. THEY ARE SERVING ON CRACK TRAINS OF AMERICA'S LEADING ROADS.



FOR REDUCED WEAR AND SATISFACTORY LUBRICATION UNDER ALL LOAD CONDITIONS SINCLAIR PROVIDES STEAM CYLINDER AND VALVE OILS SUITED TO EVERY COMBINATION OF ENGINE REQUIREMENTS.

CHICAGO AND SOUTHERN AIR LINES WHICH HAS INAUGURATED AN ADDITIONAL DETROIT-HOUSTON-NEW ORLEANS DAILY SERVICE WITH NINE INTER-CITY SCHEDULED STOPS HAS FLOWN ITS FLEET OF DIXIELINERS MORE THAN 18,600,000 REVENUE MILES ON SINCLAIR PENNSYLVANIA MOTOR OIL.

SINCLAIR *IS EQUIPPED TO SERVE YOU BETTER!*

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y

FOSTER REGULATION ENGINEERING

Saves Maintenance Time

for example:

1 Major overhaul, when necessary, without breaking the line

2 All bolts are *stud* bolts—easily loosened

3 Guide and spring easily replaced

4 Ground joint — no gasket required

5 Main valve accessible — easily reseated

6 Main valve seat ring replaceable

7 Pushrod removed from lower end

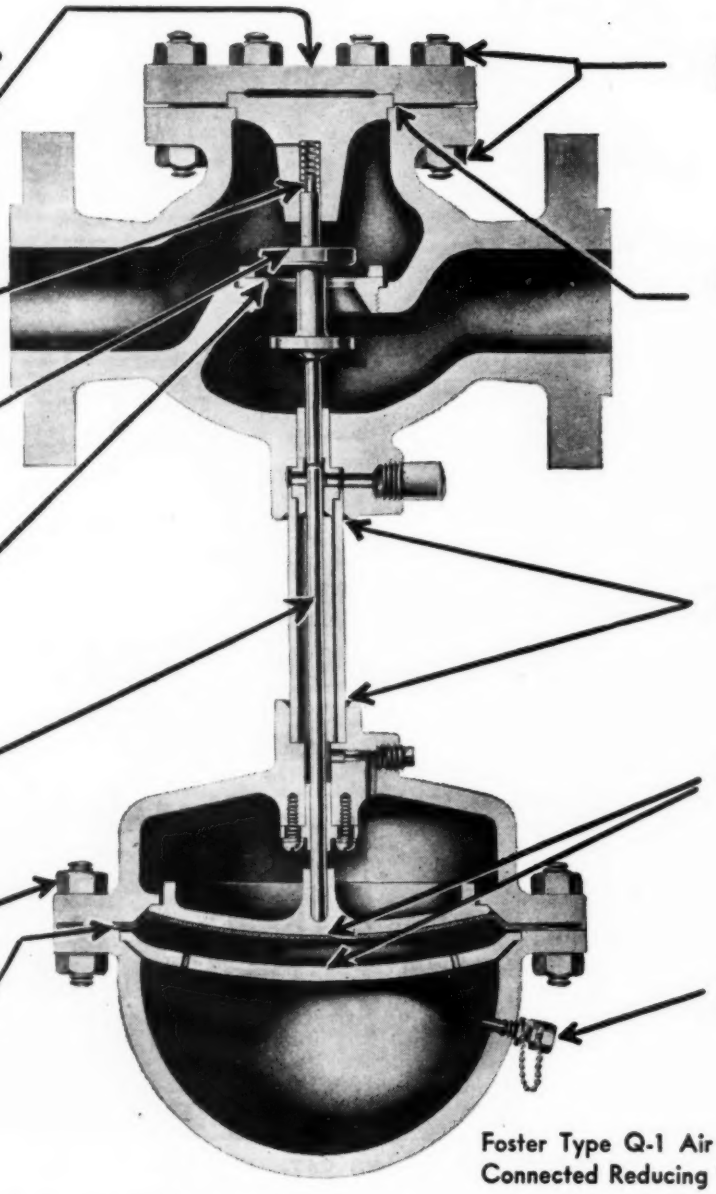
8 Brazed — no packing required

9 All smooth contact surfaces for diaphragm

2 All bolts are *stud* bolts—easily loosened

10 Diaphragm unit can be removed without disturbing rest of valve

11 Air fitting replaceable



Foster Type Q-1 Air Dome Loaded — Direct Connected Reducing Valve for Steam Service

Foster Regulation Engineering, built into each valve, is your assurance of years of accurate trouble free operation.

★ BUY MORE BONDS ★

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK 1, N. J.

6-YE-1

Better Lubrication with

Gulf Parvis Oil

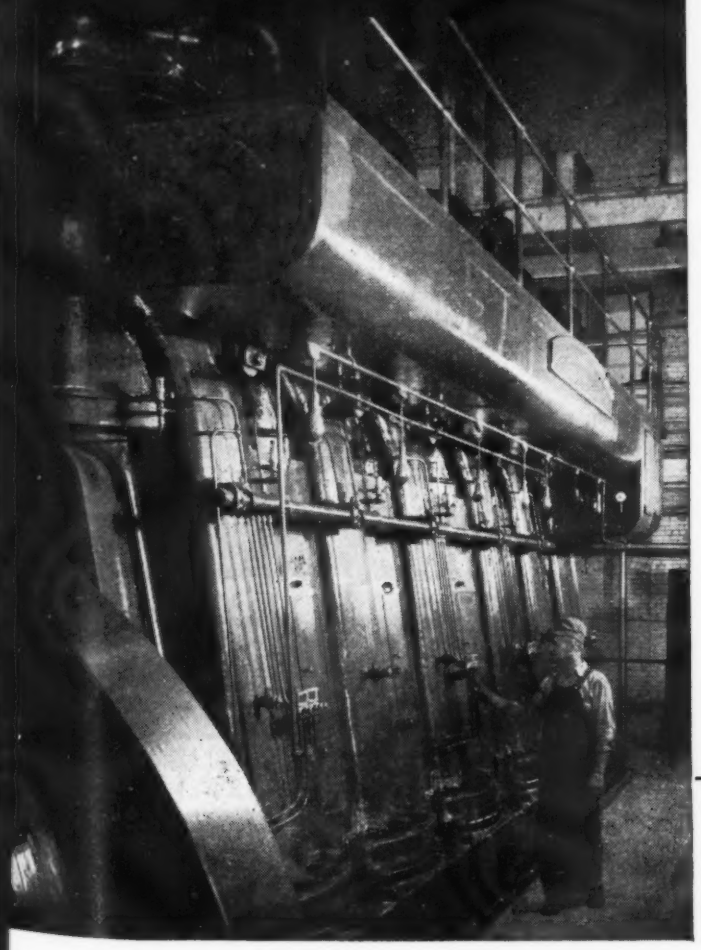
means lower maintenance costs!

MAINTENANCE COSTS usually tell the story of lubrication efficiency —and the operating records of hundreds of Diesels in industrial and marine service prove that maintenance costs *go down* and *stay down* when Gulf Parvis Oil takes over the lubricating job.

This quality Diesel lubricating oil provides a higher degree of protection to vital parts—helps prevent excessive wear that leads to shutdowns and high maintenance costs. And here's another important plus value you get when you use Gulf Parvis Oil: The helpful counsel of Gulf Service Engineers, *specialists in scientific Diesel engine lubrication.*

Make sure your Diesels are getting the kind of lubrication that helps insure uninterrupted power output and low maintenance costs. Write, wire, or phone your nearest Gulf Office today and ask a Gulf Lubrication Service Engineer to call.

Gulf Parvis Oil
provides the kind of protection
your Diesels need now



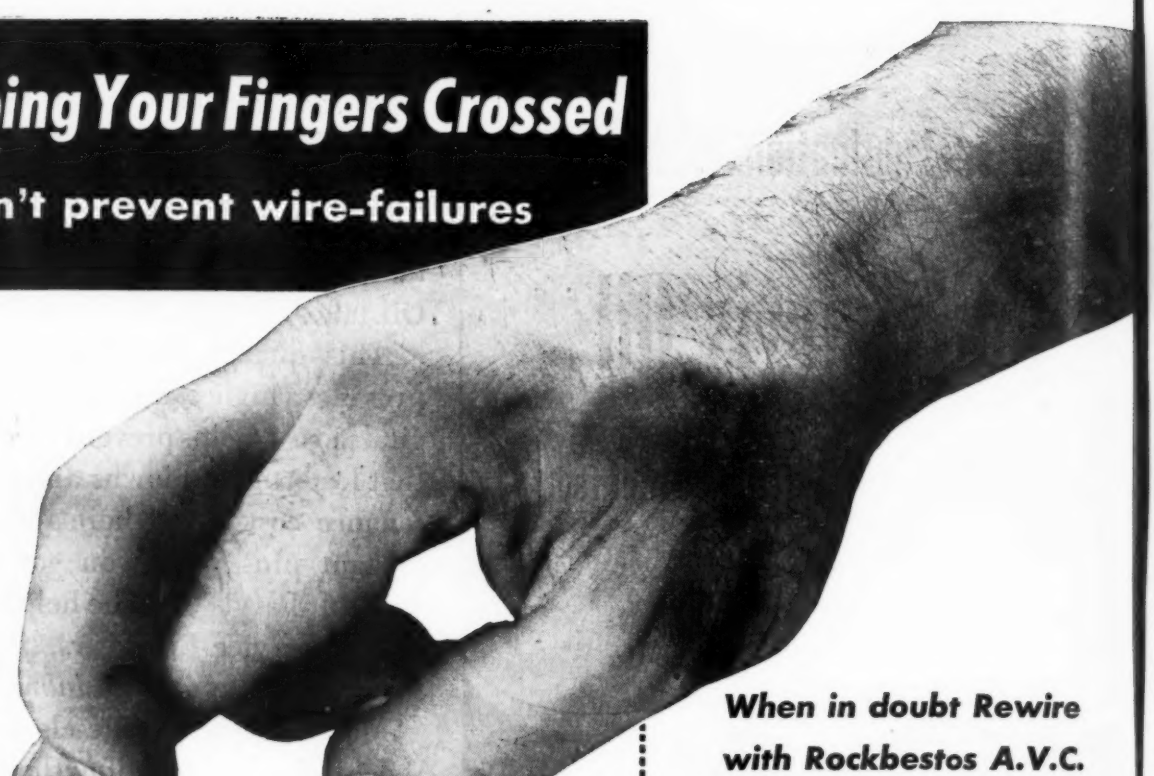
Lubricated with Gulf Parvis Oil, this Diesel has delivered dependable, low-cost service for 18 years—no operating troubles, no repairs to lubricated parts during this period.

Gulf Oil Corporation · Gulf Refining Company
DIVISION SALES OFFICES:
Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

Keeping Your Fingers Crossed

won't prevent wire-failures



Do you hope for the best and expect the worst when you think of the war-time beating some of your power, control and lighting circuits have been taking for the past 4 or 5 years? Wiring installed in tough locations when you had to use anything you could get—even though it wasn't built to take overtime abuse under high ambient temperatures or baking overloads?

Then don't wait for trouble! Protect plant operations and production schedules by rewiring circuits that are ready to blow with Rockbestos A.V.C. wires and cables. They are designed to give trouble-free service under severe operating conditions. And they stand up where other wires fail because their *permanent* impregnated asbestos insulation is resistant to heat, flame, oil, grease, moisture, alkalies and corrosive fumes and won't bake brittle, crack, flow, de-center, rot or swell.

Play safe! Put wire-failure insurance into trouble making circuits by installing Rockbestos *permanently insulated* wires, cables and cords. For recommendations, a catalog or samples, write to the nearest district office or New Haven.

ROCKBESTOS PRODUCTS CORPORATION
995 Nicoll Street, New Haven 4, Conn.

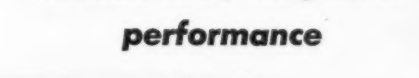
FOR VICTORY . . . BUY WAR BONDS

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

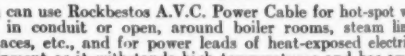
When in doubt Rewire with Rockbestos A.V.C. Wires, Cables and Cords for trouble-free, long-lived performance



ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated felted asbestos, varnished cambric and asbestos braid. Other constructions for service voltages to 5000.

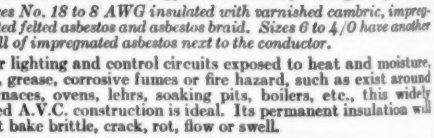
You can use Rockbestos A.V.C. Power Cable for hot-spot wiring, in conduit or open, around boiler rooms, steam lines, furnaces, etc., and for power leads of heat-exposed electrical equipment as it withstands high temperatures and has ample moisture resistance. Use similarly insulated Rockbestos A.V.C. Motor Lead Cable for motor leads and coil connections.



ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of impregnated asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.

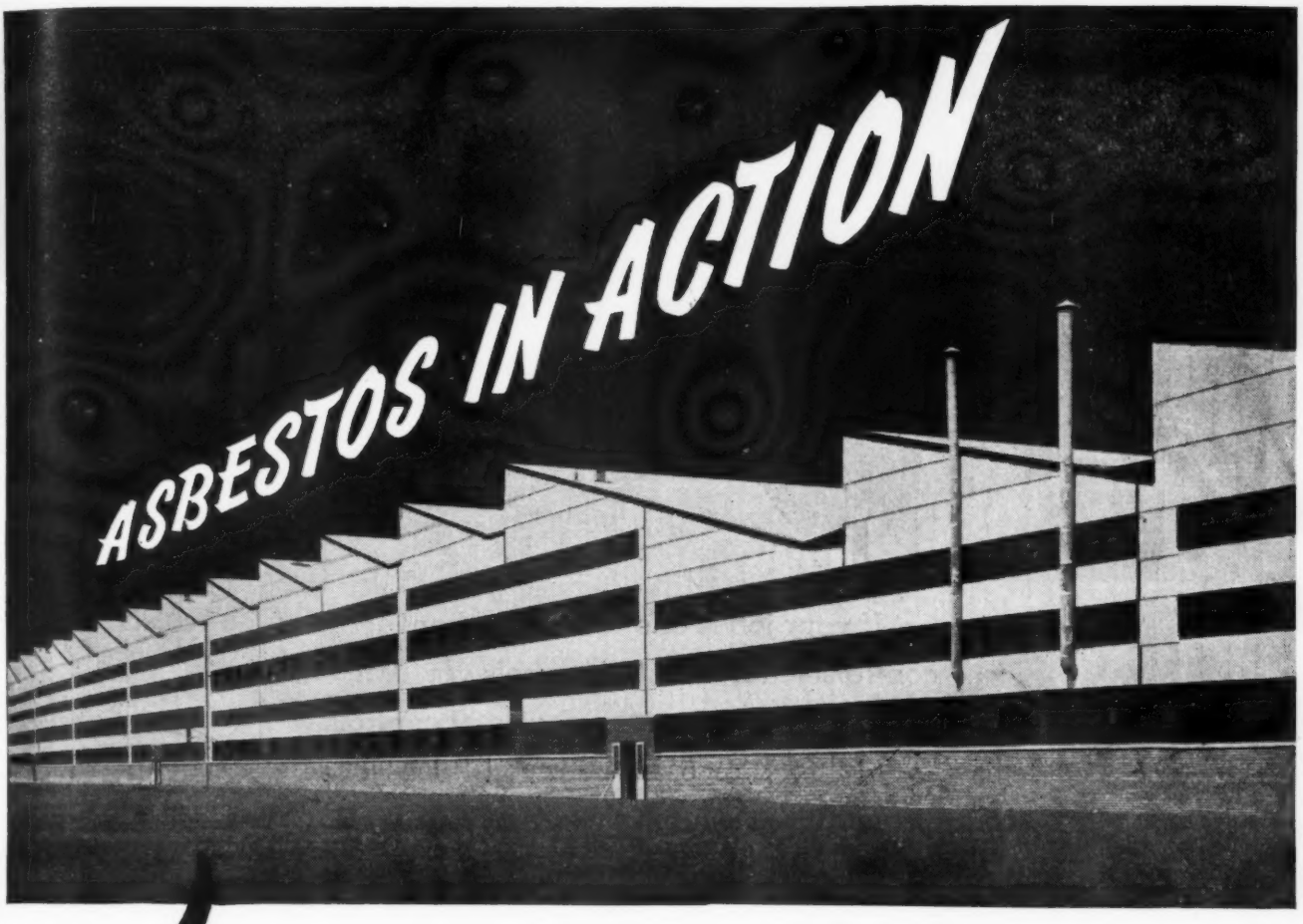


ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors with individuals insulated like Power Cable, cotton braid covered, and cabled with an asbestos braid overall. Standard strandings A.W.G. No. 12—19/$25 and No. 9—19/$22. Other strandings on order.

Designed for use in equipment requiring a multi-conductor control cable capable of withstanding high temperatures, this cable is widely used in the control systems of electric cranes and other equipment used in steel mills. The insulation is unaffected by heat, corrosive fumes, oil or grease and has ample moisture resistance.

A few of the 125 different wires and cables developed for severe operating conditions by Rockbestos.



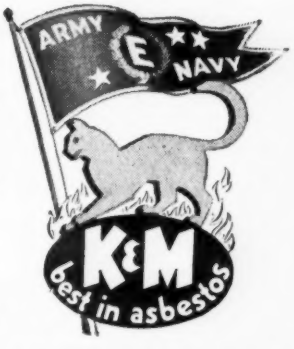
"Century" Asbestos Corrugated
MAKES THIS PLANT MODERN

This vast aircraft plant chose the *right materials.* It is built with K&M "CENTURY" ASBESTOS CORRUGATED and FLAT LUMBER . . . the perfect material for industrial roofing and siding.

Nature made Asbestos

"Century" Asbestos Corrugated and Flat Lumber is a typical example of how Keasbey & Mattison has made Asbestos serve modern construction. Here are six good reasons why it pays to use this material for building new plants, renovating old ones.

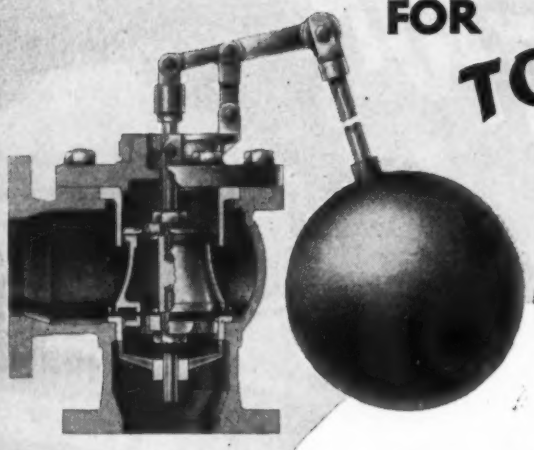
1. It is *tough* . . . a combination of asbestos fibre and portland cement, produced by tremendous hydraulic pressure.
2. It is an *attractive* material . . . needs no surface finish or applied decoration.
3. It is an amazingly adaptable material. Comes in 19 different sizes.
4. It is economical because it is maintenance free.
5. It is completely fire resistant.
6. Installation time is reduced to a minimum.



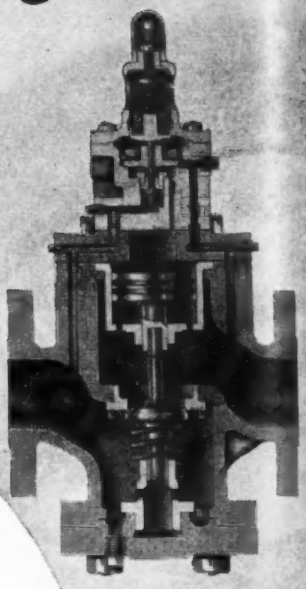
Thousands of plants, throughout the country, have found satisfaction with K&M "Century" Asbestos Corrugated and Flat Lumber. You'll find satisfaction too. You'll save time and money, and avoid risk, when you build the modern, "Century" way. Bring your problem to your authorized Keasbey & Mattison Distributor. He is well supplied to meet your material and erection requirements for "Century" Asbestos Corrugated and Flat Lumber.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Choose HEAVY DUTY Controls FOR TOUGH SERVICE DEMANDS



SCHADE No. 7 Single Seated, Balanced Float Valve.



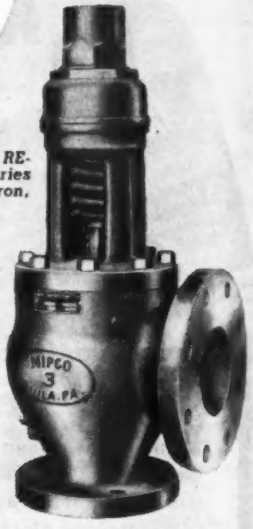
SCHADE No. 230 – Internal pilot Operated Pressure Regulator.

If your job is one that is hard on controls—that calls for controls you can depend upon . . . then the choice of controls is of vital importance. To help you select those controls with the reliability you need for your application . . . call upon the combined engineering staffs of "Associated Companies." Through "Associated Companies," an unusual control engineering experience is at your service, without obligation. Write, tell us your control problems.

MIPCO CLASS L RELIEF VALVE — Series 50, forged steel threaded ends.

ASSOCIATED VALVE & AND ENGINEERING CONTROLS CO
an associated company
CHICAGO · ILLINOIS

MIPCO CLASS L RELIEF VALVE - Series 120, cast steel, iron, or bronze.



Controls illustrated are products of

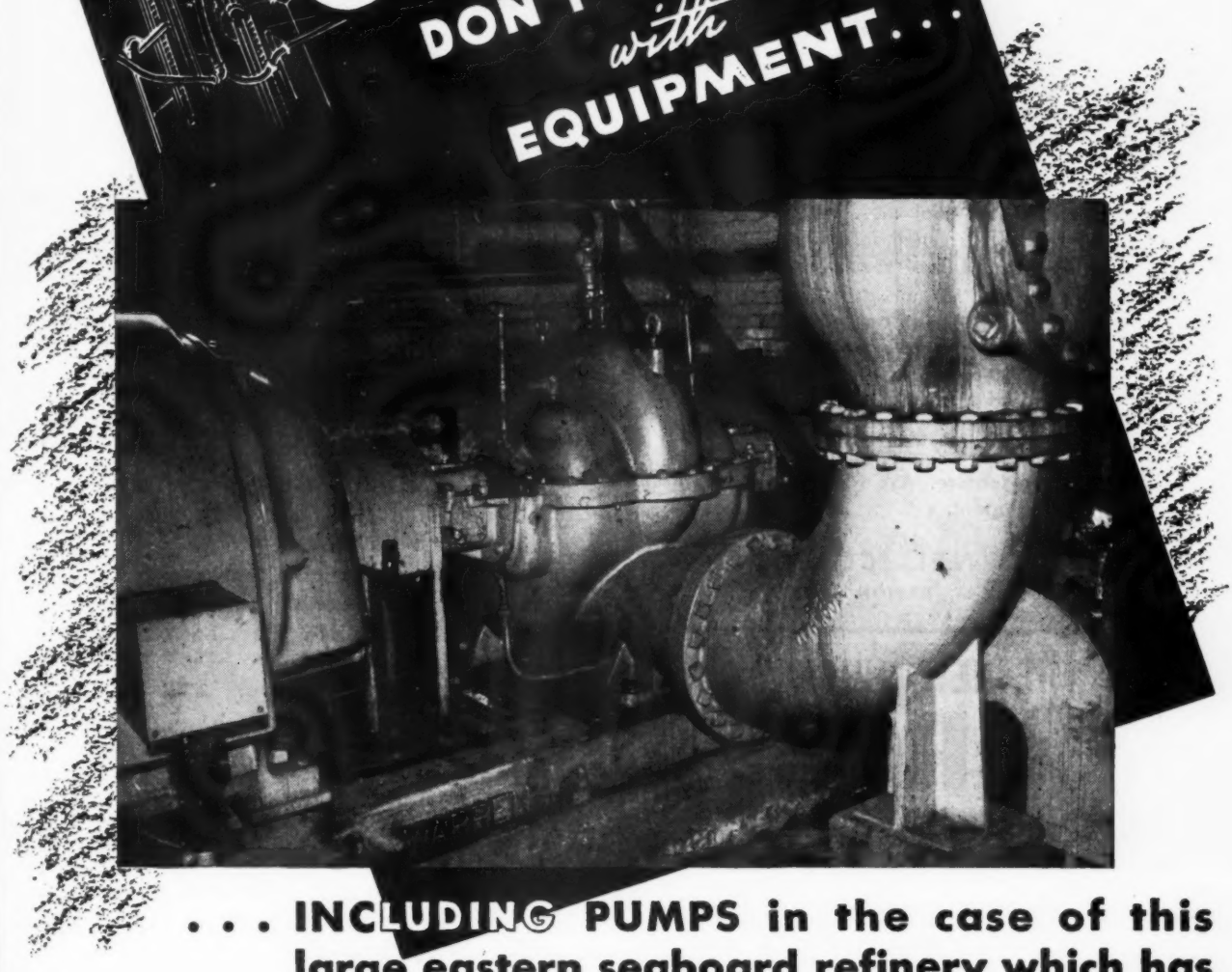
SCHADE VALVE MANUFACTURING CO.
2527 No. Bodine Street — Philadelphia 33, Pa.

MARINE AND INDUSTRIAL PRODUCTS CO.
1526 Vine Street — Philadelphia 2, Pa.

Associated Companies of

Associated Valve & Engineering Co.
510 N. Dearborn St. • Chicago 10, Ill.

OIL REFINERIES DON'T GAMBLE *with* EQUIPMENT . . .



. . . INCLUDING PUMPS in the case of this large eastern seaboard refinery which has several Warren installations.

WARREN PUMPS

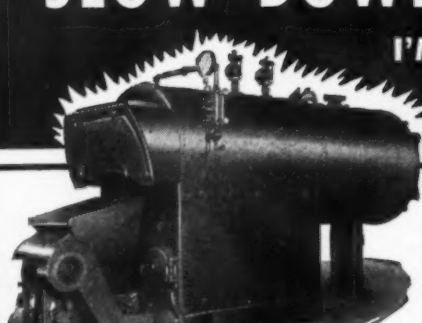
Among these is the salt water pump illustrated which has been on the job since 1936 . . . literally on the job with a perfect "attendance record". This is a 20" single stage, double suction, all bronze pump known as Warren 20-DL-22 Capacity, 14,000 GPM. Other DL type pumps available in capacities from 500 to 40,000 GPM.

For complete details ask for Bulletin 227

ARMY E NAVY

WARREN STEAM PUMP CO., INC.
WARREN, MASSACHUSETTS

"SLOW DOWN! I'M GETTING FED UP!"



Brownell Matched Unit Boiler and Stoker built to work together. One manufacturer; undivided responsibility.

THE BROWNELL STOKER senses the Brownell boiler's need for less coal . . . or for more, as the case may be. Brownell *intermittent control* regulates the rate of coal feed in ratio to the steam load.

For instance, when the steam requirement is at the minimum, the Brownell Stoker feeds only enough coal to keep the fire going. Excess coal doesn't accumulate in the firebox to smolder and smoke.

Intermittent coal feed control is an exclusive Brownell Stoker feature. Ask for literature and name of nearest agent.

THE BROWNELL COMPANY
306 FINDLAY ST., DAYTON 1, OHIO.

HERE'S THE NEW QUICK WAY TO FIX BROKEN CONCRETE FLOORS

There's no need to tie up plant traffic while broken concrete floors are being repaired. Durable INSTANT-USE will restore your floors to solid smoothness in a hurry. This new plastic resurfacer is ready for use almost as soon as it's put down. Bonds tight to old concrete, makes long-lasting heavy duty patch. Withstands extreme loads.

TAMP! TRUCK OVER!

Simply shovel INSTANT-USE into the hole or rut—tamp—and your floor is ready for traffic without the usual wait for setting. Keep a drum on hand for emergencies. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER and Details of FREE TRIAL OFFER

INSTANT-USE

FLEXROCK COMPANY
3677 Filbert St., Philadelphia 4, Pa.

Please send me complete INSTANT-USE information and details of FREE TRIAL OFFER — no obligation.

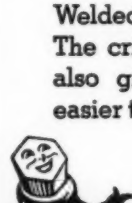
Name .....
Company .....
Address .....

• *Mr. Fillet Weld* sees a lot of Mr. Sun. You see, *Mr. Fillet Weld* holds the Hex Cross Bars of BATES • GRATES to the main bars. In doing so, he allows maximum transmission of light and ventilation through the grating. The reflecting bevels of the Hex bars and 90° corners make this possible.

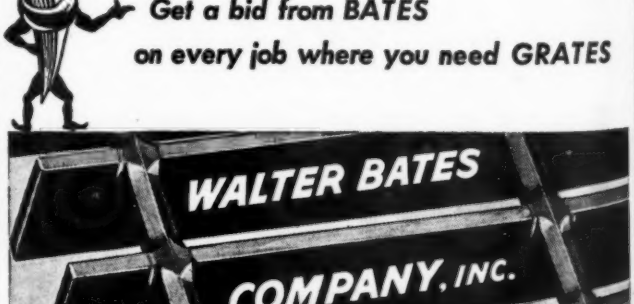
Good light and ventilation are important in every plant, as you well know.

that's only one reason why BATES • GRATES are better

• The fact that BATES • GRATES allow more light and better air circulation is only one of the distinctive advantages of BATES. The Fillet Welded Hex Cross Bars make BATES stronger. The crisp, clean edges of Hex and main bars also give you sure-footed safety. They are easier to clean and maintain. All this adds up to:



Get a bid from BATES on every job where you need GRATES



TAKE A TIP.....

NOT A TAP...

to get instant, accurate Temperature Readings!

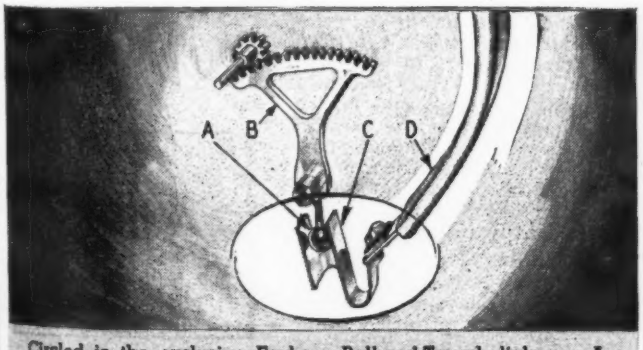
Exclusive Ball-and-Trough linkage gives Foxboro Dial Thermometers positive pointer movement, up and down the scale

When the pointer on a Foxboro Dial Thermometer points to any figure on the scale, *it always means just what it says.* And it takes no tapping of the dial face to make it tell the truth!

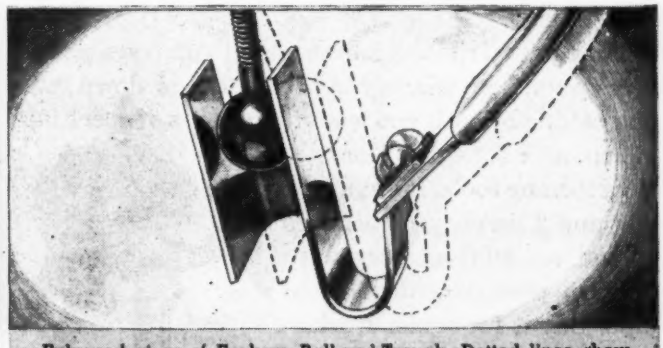
The exclusive Ball-and-Trough linkage in this better-engineered instrument eliminates lost motion . . . insures positive positioning of the pointer, no matter which way temperatures move. What's more, it also eliminates all the angularity errors of lever-type linkages . . . gives uniform, accurate calibration over the entire scale!

Add to this *inherent* accuracy, the *accuracy-in-use* features of Foxboro Dial Thermometers: rugged, all-metal construction — accessible mounting of the indicator anywhere up to 200 feet from the bulb — airplane-type dials that can be accurately read from a distance of 20 feet. You get a lot of extra value, at no extra cost!

Write for full details in Bulletin 148-7. **The Foxboro Co., 68 Neponset Avenue, Foxboro, Massachusetts.** Branches in principal cities.



Circled is the exclusive Foxboro Ball-and-Trough linkage. A stainless steel ball (A) integrally connected with the gear segment (B) slides, practically without friction, in a chromium-plated trough (C) attached to the Bourdon Tube (D).

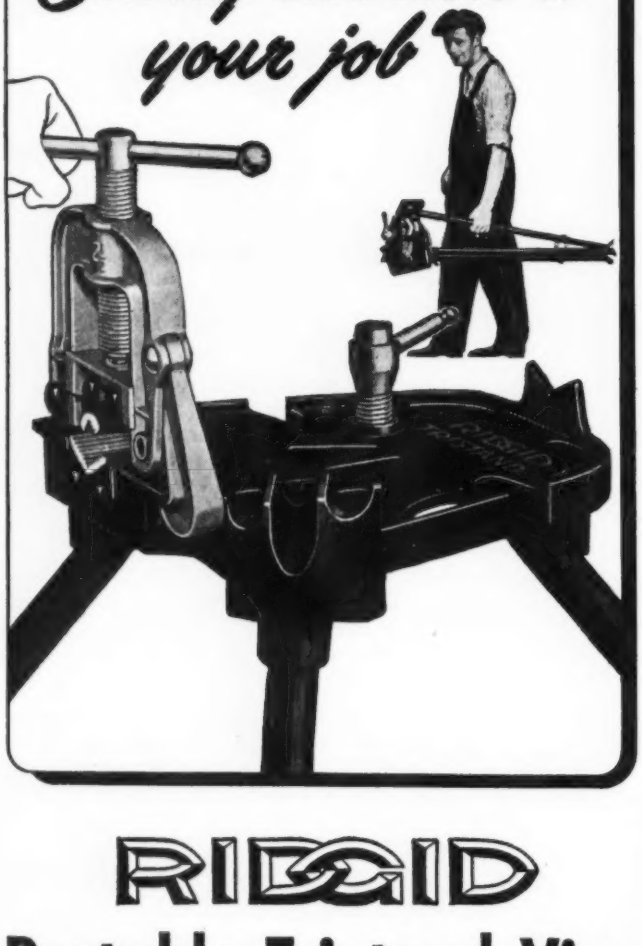


Enlarged view of Foxboro Ball-and-Trough. Dotted lines show typical change in position corresponding with change in temperature. This linkage provides constant, tangential point-contact . . . . eliminates lost motion and angularity errors.

FOXBORO REG. U. S. PAT. OFF. **DIAL THERMOMETERS**

An Efficient work-bench

Easily carried to your job



RIDGID

Portable Tristand Vise

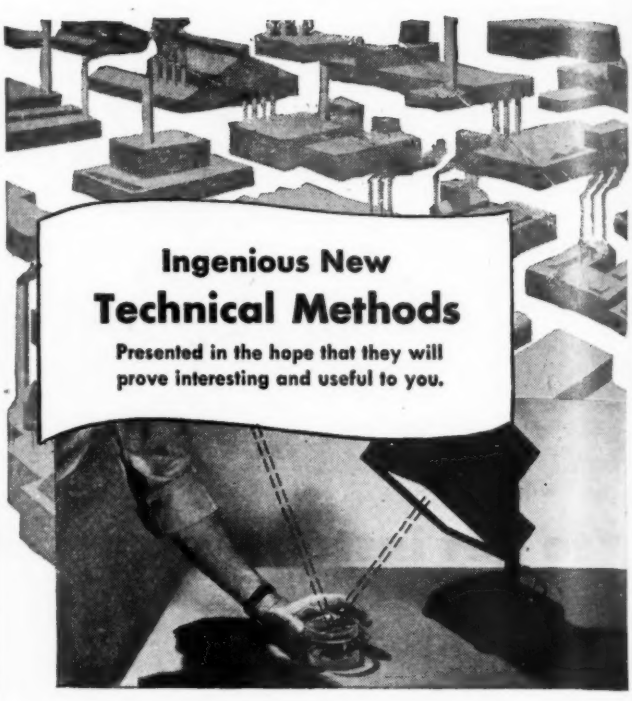
● This roomy Tristand folds up snugly, carries easily, sets up solid anywhere you need it. Screw-down feet and ceiling brace if you want them. Lots of space for oil can and dope pot, plenty of slots to hang tools. It has a pipe rest and 3 handy pipe benders — and an efficient vise with LonGrip jaws, easy on polished pipe. Buy it for easier work — at your Supply House.

Tristand Chain Vise.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.



Ingenious New

Technical Methods

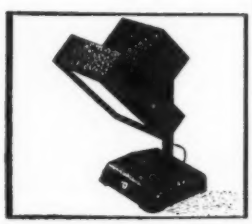
Presented in the hope that they will prove interesting and useful to you.

Now! Shop Measurements to *One Millionth of an Inch*

With Simple Light Wave Setup!

The wave length of light is the basis for this amazing new optical measuring equipment—which measures millionths of an inch as easily as a micrometer measures tenths! All that is required, in addition to a simple setup, is average eyesight, intelligence and arithmetic.

As shown above, the work was placed under the Monochromatic Light, upon the work and gauge block—and covered by the optical flat. The light, reflected back to the operator, by the top and bottom surfaces of the optical flat, creates interference bands, representing height intervals of 11.6 millionths of an inch. So that from the center of one dark band to the center of the next, the level of the work has risen or fallen 11.6 millionths of an inch. The bands, simply, are a contour map of the surface. This fact, in a simple mathematical formula, is sufficient to explain all the shop uses of optical flats, and give the work measurement, quickly and accurately.



The Monochromatic Light.

Optical Flat. Surface of Work. Interpretation of bands on truly flat surfaces.

No longer, however, can your dealer give you Wrigley's Spearmint Gum. Today, under present conditions, this product cannot be manufactured up to Wrigley's quality standards. To protect consumer and dealer alike, the makers of Wrigley's Spearmint have decided to keep the quality Wrigley's Spearmint wrapper empty. Remember this wrapper, it means chewing gum of finest quality and flavor.

You can get complete information from Acme Scientific Division of Acme Industrial Co., 200 No. Laflin Street, Chicago 7, Illinois

Z-71

PENFLEX

NOW 24" I.D. PENFLEXIBLE INTERLOCKED GALVANIZED STEEL HOSE FOR STATIONARY and MARINE DIESEL EXHAUSTS

PENFLEX Interlocked construction resists pulsations of load and pressure, absorbs vibration, prevents metal fatigue. PENFLEX Interlocked construction provides the flexibility to make quick, easy installations. PENFLEX Interlocked construction with asbestos packing gives you a pressure-tight, trouble-free exhaust connection. PENFLEX 24" Interlocked, the largest hose in the PENFLEX line, has a bending radius of approximately seven times its diameter and a working pressure of 15 to 25 psi. PENFLEX Interlocked construction requires no special tools or heat to bend.

Complete range of sizes from 5/32" I.D. to 24" I.D.

PENFLEX
Hose and Tubing is also available for other flexible connections on Diesel Installations.

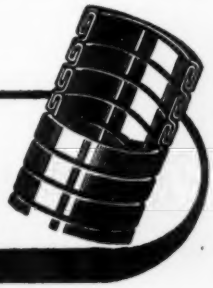
PENFLEXWELD
for Fuel Oil and Starting Air.

PENFLEX
Interlocked for Lubricating Oil, Circulating Water, Exhausts and Air Intake Lines. Write for Bulletin 71.

PENFLEX METAL HOSE

PENFLEX

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7238 POWERS LANE Established 1902 **PHILADELPHIA 42, PA.**

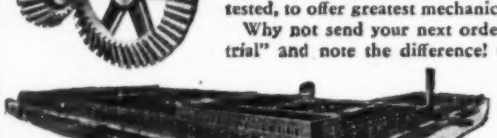


FOR SMOOTH-RUNNING
Precision Drives
USE
"*Industrial*"
GEARS • RACKS • SPROCKETS

ANY SIZE
ANY MATERIAL
ANY QUANTITY

IT doesn't pay to skimp on gears, racks or sprockets—the best always pay in the long run! "Industrial" Gears, Racks and Sprockets are of the finest, being accurately cut to specifications and rigidly gauged, inspected and tested, to offer greatest mechanical efficiency.

Why not send your next order to "Industrial" and note the difference! Catalog and Engineering Handbook on request.



The Plant that Quality and Service Built

INDUSTRIAL GEAR MFG. CO.
4543 VAN BUREN STREET CHICAGO 24, ILLINOIS

FOR 12 YEARS
our business has grown on
THIS *Guarantee*

MORE B.T.U.'s FROM
ANY GRADE OF FUEL
IN ANY BOILER
COAL OR OIL-FIRED
HIGH OR LOW PRESSURE

follows almost immediately after use of

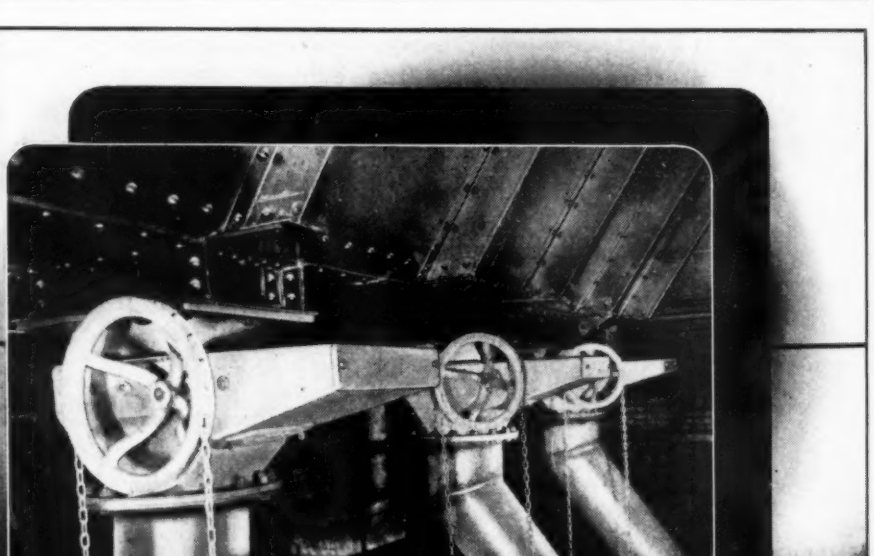
No-Karb Soot Remover

NCC Sludge Solvent

Not merely in isolated cases, but everywhere that No-Karb or NCC is used, the most sceptical engineers make the same report: "Impressively better performance and elimination of from half a day to three days formerly needed for removing fire scale and soot." Brief, fact-packed technical bulletin free on request.

NUTMEG CHEMICAL CO.
Dept. P., 223 State St., New Haven 10, Conn.
Distributors! Salesmen! A few choice territories open.

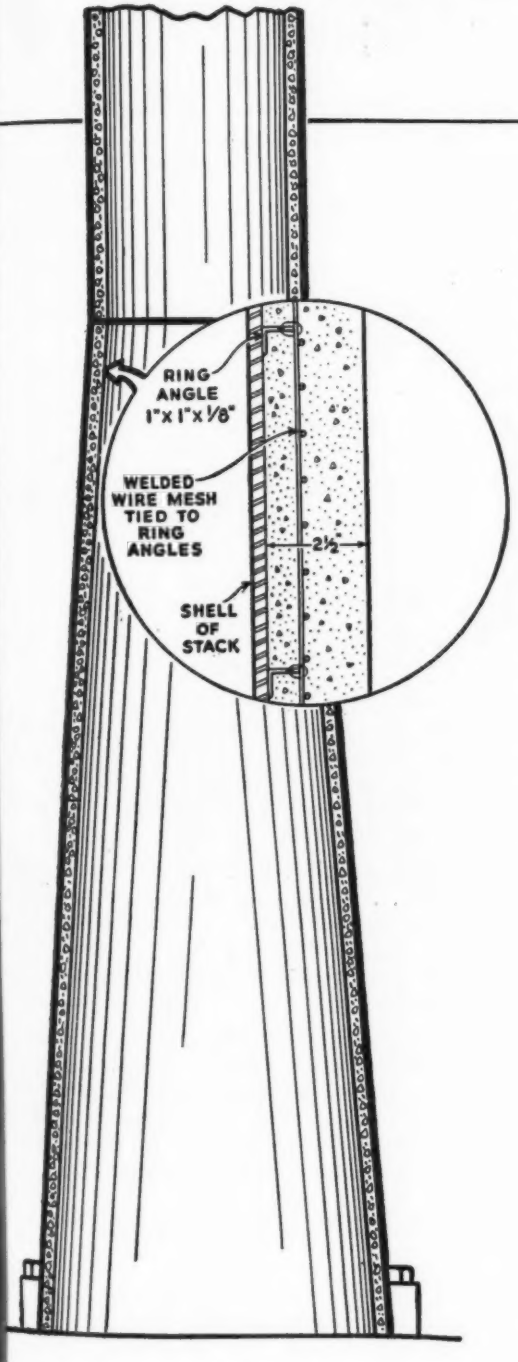
Brother, Here is a Coal Valve that won't stick!



The U-shaped Gate incorporated in the design of all S. E. Co. Coal Valves prevents water and coal from contacting the two racks and supporting rollers, thus these parts are protected from corrosion and from accumulations of coal dust. Result—no sticking. S. E. Co. Coal Valves open and shut easily at all times. Catalogs and data sheets are available. Address Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio.

STOCK
ENGINEERING CO.
S.E.Co. Coal Valves and Coal Scales, CONICAL Non-Segregating Coal Distributors

PROTECT STEEL and IMPROVE DRAFT with LUMNITE STACK LININGS



Corrosion-resistant linings insure long life for steel stacks. Insulation prevents oxidation, keeps gas temperature up and boosts the draft. LUMNITE linings are refractory, insulating and resistant to corrosion.

Stop oxidation, prevent the corrosive action of sulphurous flue gases, insulate the steel from high temperatures, and you have forestalled the enemies that destroy steel stacks. The jointless LUMNITE linings are in close contact with the steel. They allow no "breathing"; aggressive condensate cannot reach the shell of the stack.

A LUMNITE lining only 2½ inches to 3 inches thick gives full protection, while it allows maximum effective draft area. The efficiency of an old stack is increased; a new stack may be designed for greatest economy of steel.

In new stacks or old, it's easy to install these LUMNITE linings. Reinforcing mesh is attached to steel angles or other projections welded to the steel shell . . . the mixture of LUMNITE and insulating, corrosion-resistant aggregate is applied over the reinforcing mesh . . . then, 24 hours later, the lining is ready for service.

7 Ways to Use LUMNITE in Power Plants

1. Ash Pit and Cinder Catcher Linings.
2. Coal Bunker Linings.
3. Flue and Duct Linings
4. Steel Stack Linings.
5. Mortar for Brick Chimneys and Linings.
6. Castable Refractories.
7. Overnight Structural Concrete

For information on stack linings and other uses of LUMNITE in the power plant, write:

THE ATLAS LUMNITE CEMENT COMPANY

(United States Steel Corporation Subsidiary)

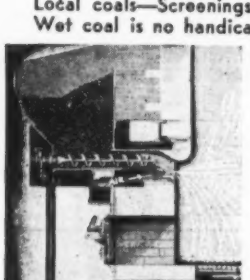
Chrysler Building **New York 17, New York**

FYR-FEEDER STOKERS

MULTIPLE SPREADER

BURN COAL LIKE OIL!

Save with Fyr-Feeder—Burn less Coal—Cheaper coal—Local coals—Screenings—Coal yard sweepings, wet or dry—Wet coal is no handicap.



FYR-FEEDER

exclusively uses

← **Air JET Coal PROPULSION**

Fines burn in suspension, larger pieces are spread evenly over grates.

Fyr-Feeder increases boiler capacity—responds instantly to sudden load variations—requires no special skill or experience to operate—thin fuel bed eliminates clinkers—makes firemen's work much easier—no banking losses.

CHANGE OVER TO FYR-FEEDER NOW!

Easily installed in minimum time.

Fyr-Feeders are built in sizes to burn from 300 to 12000 lbs. of coal per hour. If you are or expect to be in the market for automatic coal burning equipment

Wire or Write

FYR-FEEDER Stoker Division

AMERICAN COAL BURNER COMPANY

Engineers

32-18 E. Erie St. **Chicago 11, Ill.**

Specify: FOR BETTER VISIBILITY

ERNST

HIGH and LOW Alarm INCLINED Water Columns

PRISMATIC REFLEX TYPE

FIG. 32

OR

SPLIT GLAND TYPE

FIG. 1

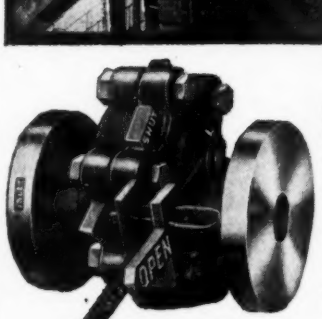
Send for Catalog 45

TEL.: LIVINGSTON 6-2356

ERNST WATER COLUMN & GAGE CO.

LIVINGSTON, NEW JERSEY

The Danger Line ... but



Valve open and locked open

Valve shut

No matter WHAT happens on this boiler water-column line — this plant will not be shut down for repairs. Nor will the boiler-room crew be exposed to any danger while repairs are made.

These EVERLASTING water-column valves *keep your boilers going* . . . keep connections to water-column free from clogging . . . permit replacement of broken gage glasses . . . allow repairs to try-cocks and gage-cocks — without danger of your men being scalded while repairs are made.

Shut these EVERLASTING valves with a quick, easy short-stroke push on the lever—and you have a drop-tight seal. No need to protect face and hands from leaking steam or water—*there is none!* No need to reduce steam-pressure or unduly hurry repairs—*your men are SAFE!*

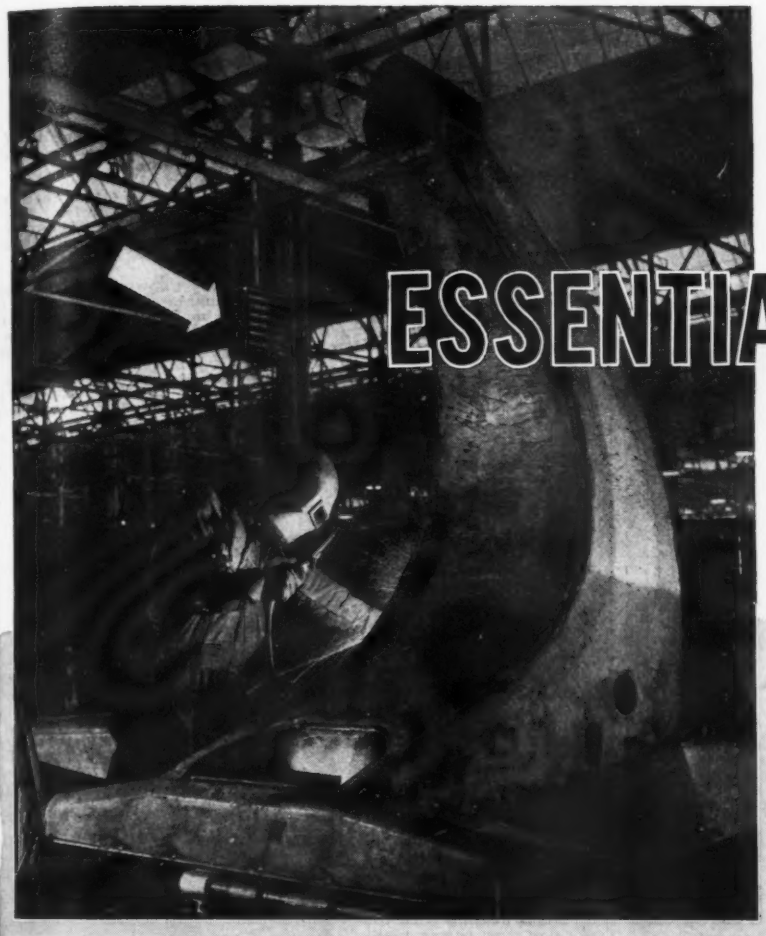
After repairs are completed . . . open these EVERLASTING valves . . . and seal the levers open. The valve indicators always show clearly which position the valves are in. And when they're open, these valves provide a straight-through unimpeded flow that *prevents* clogging.

EVERLASTING water-column valves meet all A.S.M.E. code specifications—*plus!* They have always been preferred by experienced engineers because they have proven safest on thousands upon thousands of installations. Write today for Bulletin on these valves and our complete line of blow-off valves.

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N.J.

Everlasting Valves

FOR EVERLASTING PROTECTION

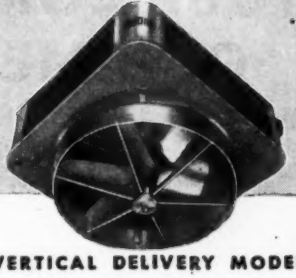


ESSENTIAL HEATING!

HORIZONTAL DELIVERY MODEL

MAKE urgently needed REPLACEMENTS with

MODINE UNIT HEATERS



VERTICAL DELIVERY MODEL

GET BULLETINS 144 and 144-A

● In war plants producing critical supplies...there are leaky, slow-heating, fuel-wasting pipe coil or cast iron radiators, or old, worn out unit heaters that need to be replaced. Make such urgently needed replacements with Modine Unit Heaters . . .

They will save fuel—as much as 25 per cent over cast iron radiation. Save upkeep and repairs. Today's replacements, properly planned, will fit into tomorrow's reconverted installations.

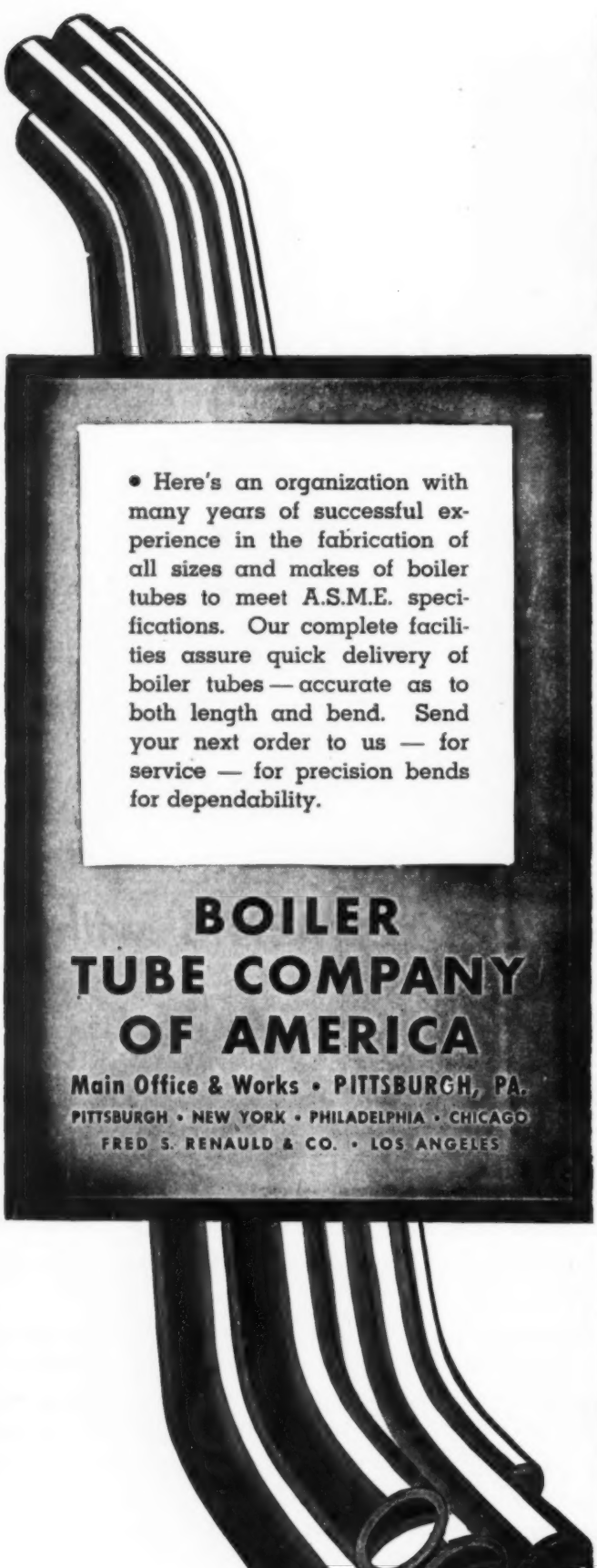
Modine's 29 years of cumulative pioneering research and experienced production skill is concentrated on turning out unit heaters capable of giving that same quality of heating performance that has made Modine Unit Heaters America's *recognized standard!*

ARMY-NAVY E

Consult your Modine representative for priority requirements

MODINE MANUFACTURING COMPANY, 1830 RACINE ST., RACINE, WISCONSIN

Modine Unit Heaters



• Here's an organization with many years of successful experience in the fabrication of all sizes and makes of boiler tubes to meet A.S.M.E. specifications. Our complete facilities assure quick delivery of boiler tubes — accurate as to both length and bend. Send your next order to us — for service — for precision bends for dependability.

BOILER TUBE COMPANY OF AMERICA

Main Office & Works • PITTSBURGH, PA.

PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO

FRED S. RENAULD & CO. • LOS ANGELES

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

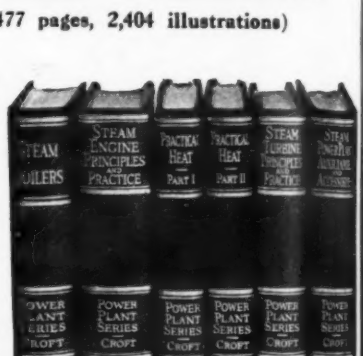
It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.

POWER PLANT PRACTICE

(6 volumes—2,477 pages, 2,404 illustrations)


STEAM BOILERS
STEAM ENGINE PRINCIPLES AND PRACTICE
PRACTICAL HEAT PART I
PRACTICAL HEAT PART II
STEAM TURBINE PRINCIPLES AND PRACTICE
POWER PLANT SERIES CROFT

The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.

No books dealing with the work of the power plant man were ever so complete—so authoritative—so practical in text and illustrations as these. The man who puts this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him in language he can understand, all the information he needs in order to get ahead in his work.

Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a Power Plant Library FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers Power Plant Practice. Here you have all the information necessary to make you indispensable on the job.

See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10-days' examination. If you decide to keep the books after examining them, just send $2.00 and then $1.00 a month until the total low price of $16.00 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

McGRAW-HILL ON-APPROVAL COUPON

McGRAW-HILL BOOK CO., INC., 330 West 42nd St., N. Y. 18

Ship to me, charges prepaid, the six volumes of the Library of Power Plant Practice. If satisfactory, I will send $2.00 in ten days and $2.00 a month until the price of $16.00 has been paid. If not wanted I will return the set to you postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name .....

Home Address .....

City and State .....

Firm or Employer .....

Position .....P 6-45

Send for this FREE CATALOG today!

THIS FREE 32-page catalog is as smart as a Quiz Kid when it comes to Recording Thermometers. It knows *and tells* just where and when to use a Recording Thermometer and how it works. It tells how a Taylor Recording Thermometer *improves product quality* and *lowers costs*, by clearly indicating where and when waste in heating or cooling media occurs, and how more efficient control would eliminate it. Here are a few other valuable facts contained in the booklet:

- Value of a permanent minute-by-minute record of process operation.
- Three types of tube system actuation — mercury, gas, and vapor.
- Wide variety of bulb forms and connecting tubings to give best resistance to erosion or corrosion and fastest possible temperature response.
- Records one, two or three related *variables* on a single chart.
- Taylor Accuratus Tubing — a special development in mercury actuated tube system which insures the accuracy of temperature records even when instrument is located several hundred feet from point of measurement.

Be sure to write for your *free* copy of this helpful catalog today! Ask for Catalog 76-J. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow and liquid level.*

ARMY E NAVY

Taylor Instruments MEAN ACCURACY FIRST

IN HOME AND INDUSTRY

BUY MORE WAR BONDS—AND KEEP 'EM!

HOPPES

FEEDWATER HEATERS

Deaerating and Non-Deaerating

Write for Bulletin

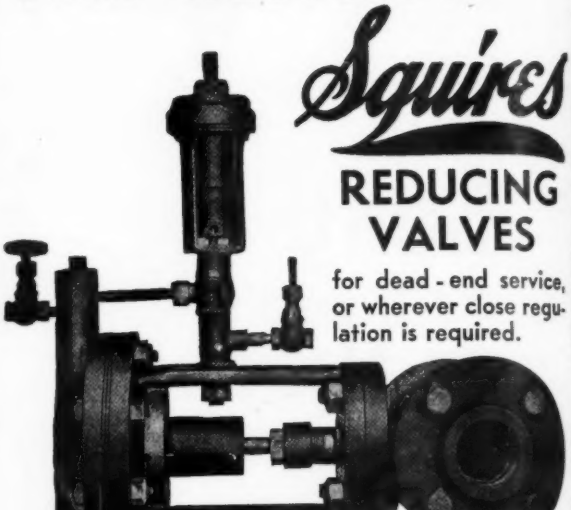
THE HOPPES MFG. CO.

Established 1881

SPRINGFIELD OHIO

USE

THE GENUINE *Squires* REDUCING VALVES



for dead-end service, or wherever close regulation is required.

Also Steam and Air Traps, Pump Governors and Boiler Feed Water Controllers.

THE C. E. SQUIRES CO.

E. 40th St. and Kelley Ave., Cleveland, O.

J&L SEAMLESS STEEL BOILER TUBES

form easier, roll in faster, and then "stay put"—

J & L TUBULAR PRODUCTS

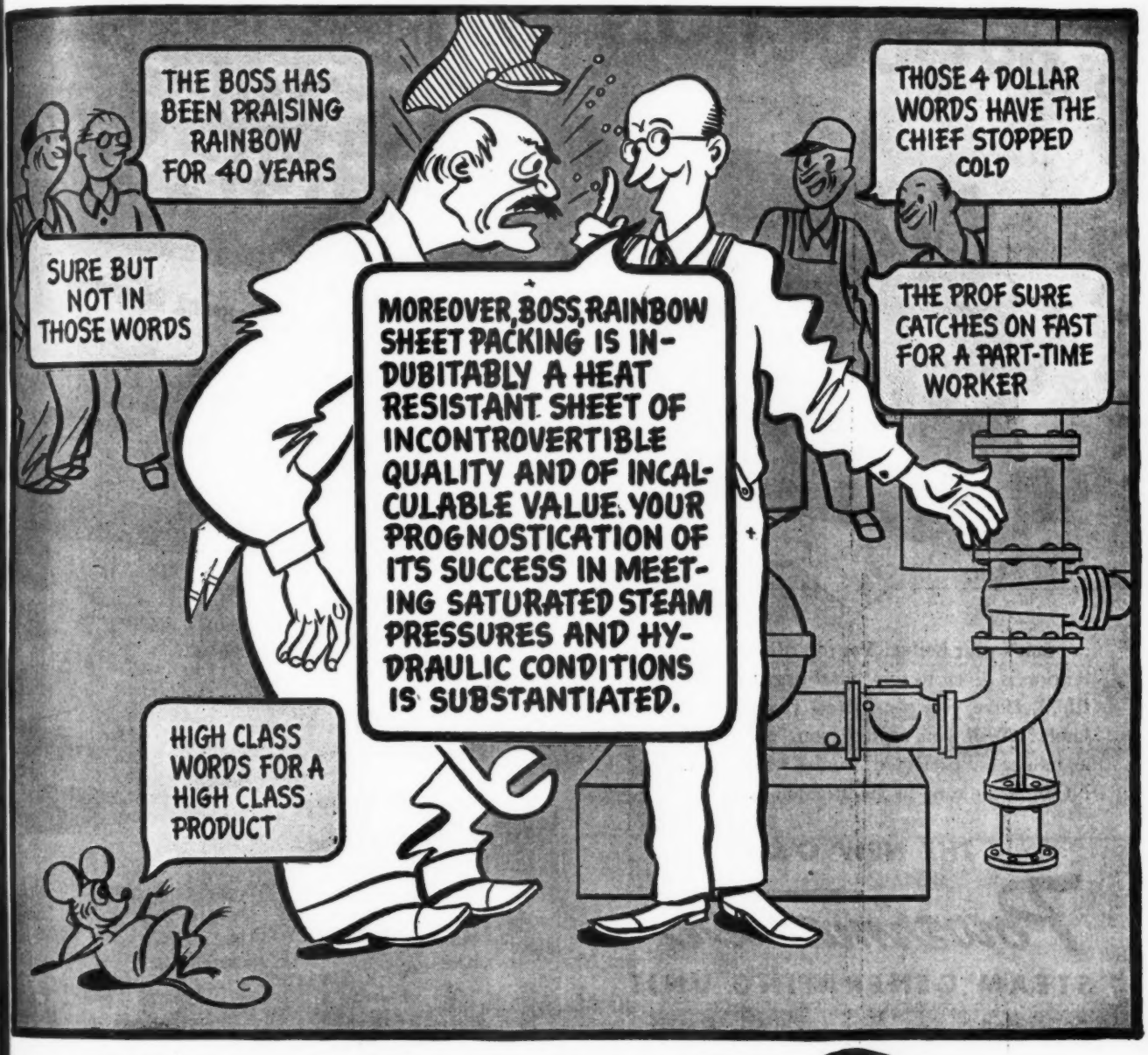
Seamless Steel Boiler Tubes
Large O. D. Pipe, Welded and Seamless
Welded and Seamless Standard Pipe
Electricweld Mechanical and Pressure Tubes

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

THE PROFESSOR TAKES A WAR JOB


THE BOSS HAS BEEN PRAISING RAINBOW FOR 40 YEARS
SURE BUT NOT IN THOSE WORDS
MOREOVER, BOSS, RAINBOW SHEET PACKING IS INDUBITABLY A HEAT RESISTANT SHEET OF INCONTROVERTIBLE QUALITY AND OF INCALCULABLE VALUE. YOUR PROGNOSTICATION OF ITS SUCCESS IN MEETING SATURATED STEAM PRESSURES AND HYDRAULIC CONDITIONS IS SUBSTANTIATED.
HIGH CLASS WORDS FOR A HIGH CLASS PRODUCT
THOSE 4 DOLLAR WORDS HAVE THE CHIEF STOPPED COLD
THE PROF SURE CATCHES ON FAST FOR A PART-TIME WORKER

RAINBOW—*Tops In Packing Since 1889*

Yes, Rainbow, the original red sheet packing, has been giving unexcelled service for 56 years. It will *not squeeze or blow out* on the job.

Packing flanges and other parallel surfaces against hot or cold water, air, saturated steam pressures up to 150 pounds, and all hydraulic conditions—that's Rainbow's specialty.

Don't invite unnecessary equipment breakdowns—order Rainbow and be sure of packing dependability.

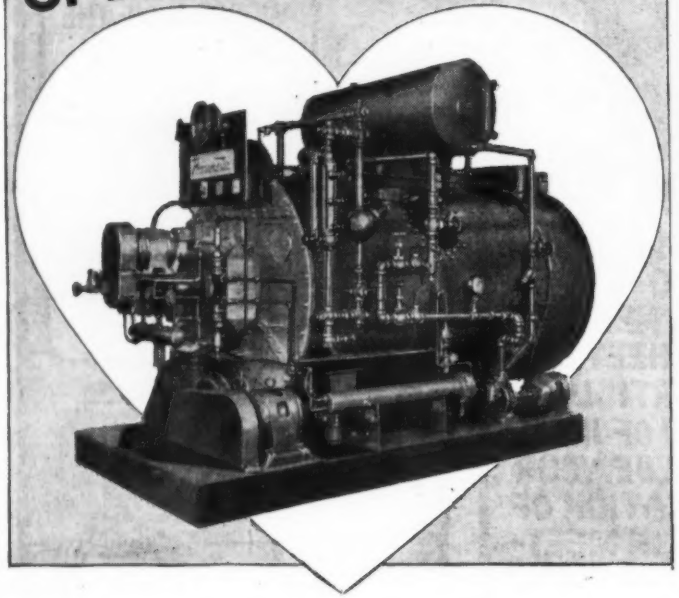
Listen to "Science Looks Forward"—new series of talks by the great scientists of America—on the Philharmonic-Symphony Program. CBS network, Sunday afternoon, 3:00 to 4:30 E.W.T.

UNITED STATES RUBBER COMPANY

Serving Through Science

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, NEW YORK

THE HEART OF PRODUCTION...



. . . that's your boiler! Yet too often too little attention is given to this "vital organ of industry's life." Have you considered *your* power plant lately? Will you replace your old boiler with a modern "packaged" unit when available? NOW is the time to investigate . . .

THE NEW O&S

Powermaster

STEAM GENERATING UNIT

. . . Engineered to give you fast, efficient, low-cost steam — Designed for compactness, space-savings, safe, quick-steaming capacity — Built for long, dependable life with minimum maintenance attention—a fully automatic unit ready to go at the flick of a switch!

Get full information—write for Bulletin # 1213—to Orr & Sembower, 974 Morgantown Rd., Reading, Pa.

ORR & SEMBOWER INC.

READING O&S PENNA.

Builders of Better Boilers Since 1885

FOR THE PEAK OF BOILER EFFICIENCY

FLUEKLEEN

Soot and Fire Scale Removing Compound

Eliminates the necessity of shutting down equipment to bring about thorough removal of soot and fire scale. Prevents further formation. Penetrates into parts which cannot be reached by mechanical or manual means.

DRY PINK

Boiler Feedwater Treatment

For steam generators of all types — high and low pressure boilers. Individually prepared after complete analysis of your boiler feedwater is made. Eliminates rust, pitting, corrosion and priming.

RUSTOFF

Rust Treatment

Loosens and disintegrates rust in hot and cold water supply systems. At the same time forms a protective coating on the clean metal which thoroughly protects it against corrosive action.

NO-SLUDGE

Fuel Oil Efficiency Treatment

Keeps the fuel oil in proper suspension. Assures a clean steady flow of oil. Prevents the sludge from forming in the bottom of the tank where the best part of the "B.T.U.'s" settle.

DOMINION CHEMICAL CO., INC.

WATER CONSULTANTS AND CHEMISTS FOR INDUSTRIAL AMERICA

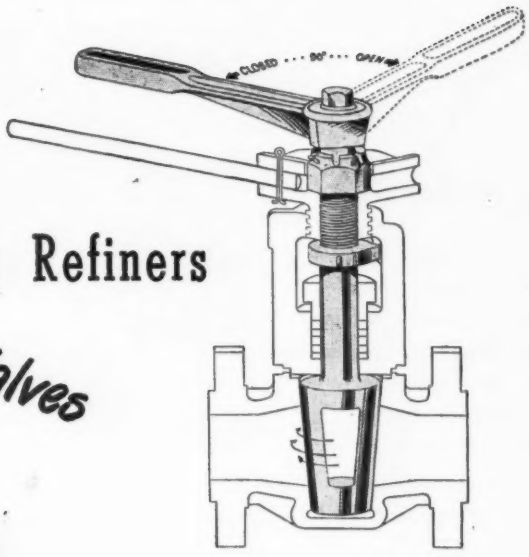
11 WEST 42nd ST. • NEW YORK 18, N.Y.

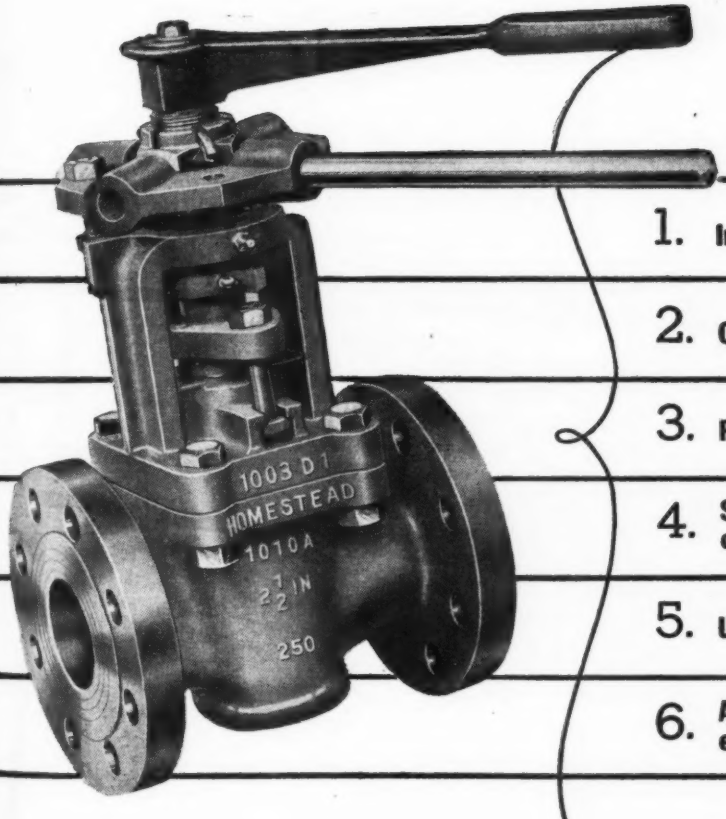
Sour Gas, Caustic and Acid

Corrosion Licked

For America's Leading Refiners

By Homestead Lever-Seald Valves





1. **Instant Stick-proof operation.**
2. **Quarter-turn fully opens or closes.**
3. **Positive seal without lubrication.**
4. **Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.**
5. **Unobstructed straight-line fluid flow.**
6. **All operating parts protected from damaging effects of service conditions and weather.**

Corrosive fluids cannot cause HOMESTEAD LEVER-SEALD QUARTER-TURN VALVES to stick or "seize." For built right into every valve is a powerful lever and screw device which relieves seating pressure between the plug and body just enough to overcome friction and permit *easy turning at all times and under all conditions.*

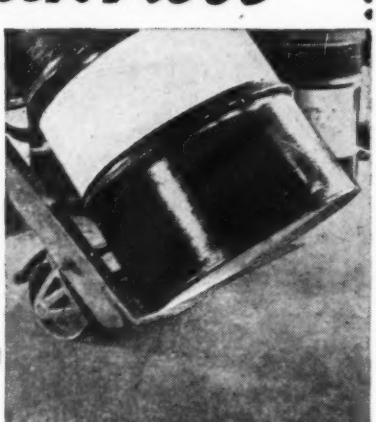
Available in metals and alloys to meet service requirements; sizes 1½" to 10"; for pressures from vacuum to 1500 pounds and temperatures from 40° below zero to 1100°F.

Our engineers will gladly cooperate with yours in solving your valve problems—without obligation, of course.

Homestead
Valve Manufacturing Company
P O. BOX 210 ★ CORAOPOLIS, PA

"M" Pennant with three additional gold stars—highest Maritime production award yet given to the men and women of any manufacturing company

Keep Floors Level—Speed Traffic with *Quick-Floor*



Use it to repair Chuck Holes · Cracks · Worn Aisles · Ramps · Welding Room Floors · Around Re-set Machines · And for Complete Resurfacing Inside or Outside

QUICK-FLOOR is ready-mixed—is easily laid (a square foot a minute)—sets by pressure—requires no drying time—can be used as soon as laid—outwears the original concrete. Unconditionally guaranteed. Write or phone today for help on your specific problems.

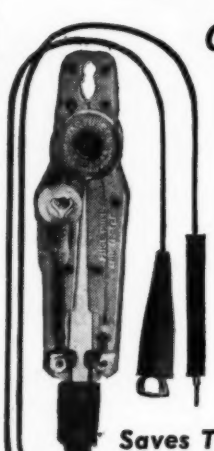
Quick-Floor

Made By DURA-TRED COMPANY

351 N. Central Park Blvd. • Chicago 24, Ill. • Van Buren 2171

The STAR ★ Fuse Puller *and* Circuit Tester

DOES 3 BIG Jobs



1—Safely removes blown fuses
2—Quickly locates dead circuits
3—Replaces old-fashioned test lamps.

Indispensable for

Electricians
Engineers
Maintenance Men

Saves Time, Prevents Shock or Injury
Eliminates Guesswork

Made of a Transparent Plastic having in one of the legs a small lamp in series with a resistance and can be used to test 110 to 250 volts circuit. It will pull fuses from 10 to 100 Amperes. Thousands of electricians find this tool handier than Test Lamps. Requires the use of only *ONE* hand to quickly and accurately test circuits.

Lamp Is Replaceable

Manufacturers of power driven machinery supply these Pliers with their machines, and earn the thanks of the maintenance men and operators.

Retails at $2.75 each, $1.50 additional for Leads.
Can be obtained from General Electric or Westinghouse Stores; also from jobbers in every large city.

STAR FUSE CO. 239 Canal St., New York 13, N. Y.

WHITLOCK
FLASH-TYPE DEAERATING FEED WATER HEATING SYSTEM

The Whitlock Flash-type Deaerating Feed Water Heating System for reducing gas inclusions has been designed for proper deaeration. The system utilizes bleed or exhaust steam and the amount of flash or "boil-off" can be varied. Normal oxygen concentrations consume iron very rapidly and the Whitlock system soon pays for itself by preventing the corrosion of boiler tubes, carrying lines, and other equipment.

Flexibility, easy maintenance and ability to accept steam at various points at different pressures make the Whitlock system . . . with simple construction and no *internal* complexities . . . the optimum equipment for boilers up to 2000 HP. Let our engineers analyze your requirements.

Write for Bulletin 645 covering Whitlock Power Plant Equipment.

The WHITLOCK MANUFACTURING COMPANY

46 South Street, Elmwood, Hartford 1, Conn.

New York • Boston • Chicago • Philadelphia • Detroit • Richmond

In Canada: Darling Brothers, Ltd., Montreal

COFFIN TURBO PUMPS

COFFIN DESIGN PREVENTS CORROSION to Pump Casing

The corrosion of pump casings due to the use of de-aerated pure water at high velocity is absent in the Coffin Turbo Pump.

1. All parts in the high water velocity zone are made of non-corrosive bronze.

2. Water leaving this zone is reduced to uniform low velocity before contacting casing.

3. Single stage design eliminates possibility of inter-stage leakage.

CAPACITIES TO 350 G.P.M.
PRESSURES TO 500 P.S.I.

THE J. S. COFFIN, JR., CO
ENGLEWOOD, N. J.

Mail the Coupon

PLEASE SEND DESCRIPTIVE BULLETIN

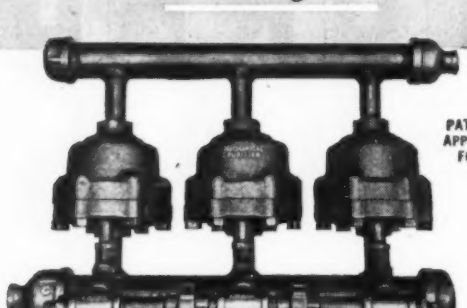
NAME _____

COMPANY _____

ADDRESS _____

P. W.

Purify Any Pressures, Air or Gas, with Bird-White Multiple Unit *Pur-O-fier*



PATENT APPLIED FOR

Three Models Available

Model A-1 furnished with a 1 inch turbo-rotor and will accommodate volumes from 1 to 8 cubic feet.

Model A-2 has a 2 inch turbo-rotor and can accommodate volumes from 10 to 35 cubic feet.

Model A-4 has a 4 inch turbo-rotor and can accommodate volumes from 35 to 100 cubic feet.

Bird-White multiple unit Pur-O-fiers save time and money by protecting air-operated machines, gauges and controls from contamination. They give positive purification to air or gas lines regardless of fluctuating pressures or high volumes.

The perfectly balanced Turbo-Rotor purifying action makes them sensitive to both regular and intermittent pressures. Write for Bulletin 10 giving complete details.

BIRD-WHITE COMPANY
Dept. PM,
3119 W. Lake Street • Chicago 12, Ill.

With **WEDGE** *Split* CHILL RINGS
you can use
LIGHTER WALLED PIPE
and get STRONG REINFORCED Joints

Split Feature Patented

It is now possible to use LIGHTER WALLED PIPE by welding joints with WEDGE Chill Rings with the patented SPLIT Feature. They REINFORCE the joints, therefore, lighter pipe can be safely used. This lowers pipe cost and reduces weight. Many Engineers are using WEDGE Chill Rings on important jobs where they cannot risk failures. They save time and labor—less skilled help can do good work and skilled help can do much more. If you weld pipe, investigate.

Write for circular and prices

WEDGE PROTECTORS, INC.
9524 Richmond Ave. Cleveland 5, Ohio

WEDGE CHILL RINGS SAVE MONEY

Why the *Automatically* CONTROLLED Belt Tension

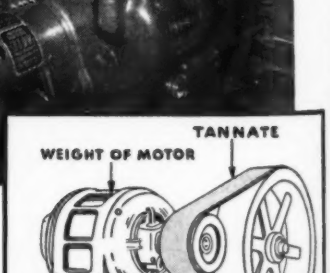
of the TANNATE-ROCKWOOD Drive provides Greater Efficiency . . . Lower Maintenance!

The Tannate-Rockwood Drive provides a simple means of maintaining correct belt tension. Too little tension permits a belt to slip . . . wastes power—too much tension causes wear on both belt and bearings.

The Tannate-Rockwood Drive avoids both of these conditions by assuring correct tension automatically . . . by the weight of the motor on the pivoted Rockwood base. It is carefully designed to do just that. The Tannate Belt, because of its great strength and flexibility and unusual endurance keeps maintenance costs down . . . assures long life.

Get a Tannate-Rockwood Drive for floor, wall, ceiling, or vertical drives; using small or large motors. *Get more details now.*

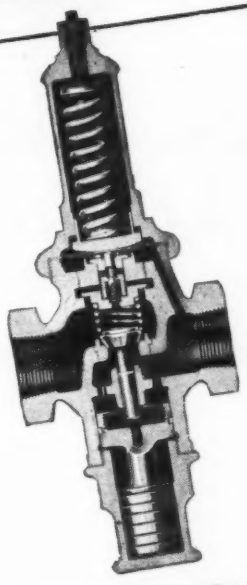
A vertical base type Tannate-Rockwood Drive operating a lathe in a metal working plant.



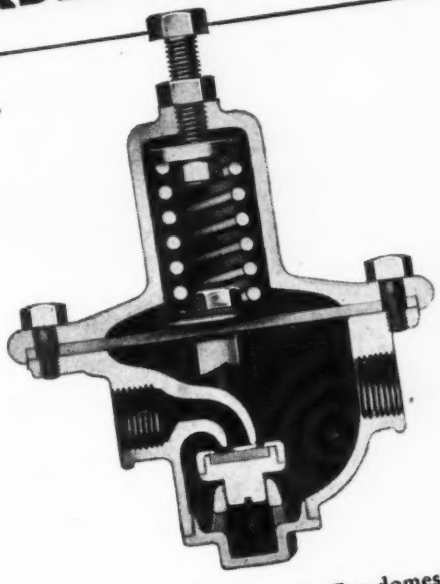
RHOADS *Tannate-Rockwood* **SHORT CENTER DRIVE**

J. E. RHOADS & SONS
35 N. SIXTH ST. PHILADELPHIA 6, PA.
NEW YORK • CHICAGO • ATLANTA

Masoneilan Regulators HURDLE High Costs



No. 11—STEAM SERVICE. For reducing steam pressures. Pilot operated. Sizes—Bronze up to 2″; Iron 2½″–4″. Reduced pressure ranges between 5 and 225 lbs.

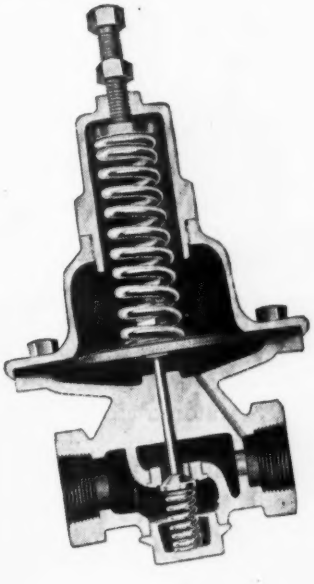


No. 227—WATER SERVICE. For domestic or industrial water systems. Requires no attention for years. Sizes ¼″ to 2″. Reduced pressure ranges between 10 and 60 lbs.

MASONEILAN

MASONEILAN STRAINERS Prevent scale, dirt, chips, etc. from damaging regulators, traps, valves and pumps . . . use Masoneilan Strainers. These precision-made strainers keep out all foreign matter. They'll eliminate maintenance delays and save you money.

No. 414—AIR SERVICE. For reducing air pressure in industrial service. Recommended for dead end service. Sizes ¼″ to 2″. Reduced pressure ranges between 10 and 60 lbs.



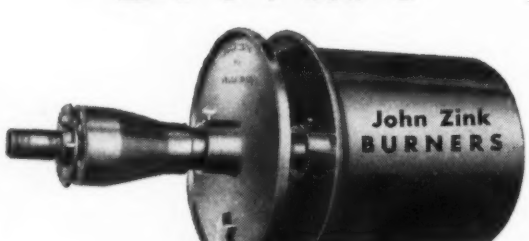
Whether your pressure reducing problems concern steam, water or air, Masoneilan Regulators can and will eliminate your control headaches. These dependable pressure regulators reduce waste, cut maintenance costs and save money by holding pressures where you want them, providing accurate performance under usual operating conditions. They are easy to install and maintain and give you years of service.

Write for catalog No. 73. It contains complete information.

MASON-NEILAN REGULATOR CO., 1186 Adams St., Boston 24, Mass.

New York Chicago St. Louis Philadelphia Houston Pittsburgh Tulsa Los Angeles
Toledo Atlanta San Francisco Mason Regulator Co. of Canada, Ltd., Montreal, Canada

"BI-MIX"



Industry's Most Versatile Burner

John Zink BI-MIX BURNERS will produce just about any type of heat pattern desired—Heat in front of the furnace—Heat in back of the furnace—Heat in the center of the furnace—or Uniform Heat throughout the furnace.

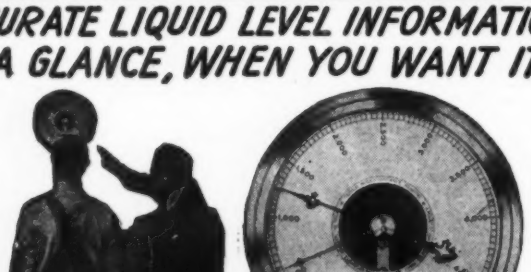
Write for illustrated bulletins on BI-MIX

JOHN ZINK COMPANY

TULSA, OKLAHOMA

342 Madison Ave., New York, N. Y.

ACCURATE LIQUID LEVEL INFORMATION AT A GLANCE, WHEN YOU WANT IT—



WITH

LIQUIDOMETER *Tank Gauges*

"THEY'RE ALWAYS DEPENDABLE"

100% automatic.

No pumps, valves, or auxiliary units needed to read them.

Models available for either remote or direct readings.

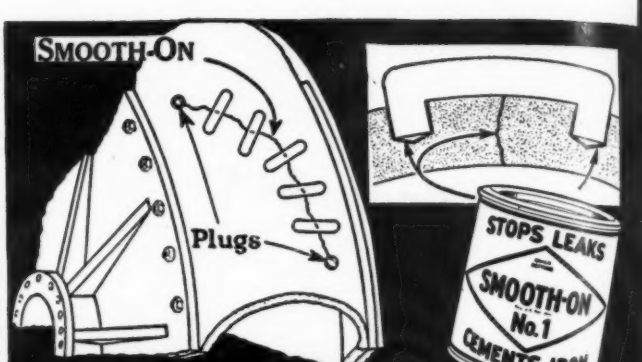
Accuracy unaffected by specific gravity of tank liquid.

Approved by Underwriters' Laboratories for gauging hazardous liquids.

Write for complete details.

THE LIQUIDOMETER CORP.

9-16 SKILLMAN AVE. LONG ISLAND CITY, L.I.N.Y.



6 Weeks' Tie-Up

averted by this *1 Day* SMOOTH-ON *Repair*

When the pump casing on a U. S. Government dredge developed a long, diagonal crack, a 6 weeks' tieup of the dredge was threatened. But read what the engineers did.

They drilled and tapped both ends of the crack and inserted plugs to check spreading. Then they tamped the crack full of Smooth-On No. 1 Iron Repair Cement and drew the edges tightly together with staples fitting into holes drilled in the casting and anchored in with more Smooth-On. The whole job took less than a day, and the result was a pressure-tight repair.

This is the sort of speedy, economical, effective repair that Smooth-On No. 1 has been used for in industrial plants, process and power plants, factories, and shops for 50 years . . . saving equipment replacements, time and money. It is why there's scarcely an engineer, maintenance man or repairman who does not keep Smooth-On handy, for both emergency and routine repairs. Costs little, easy to us—no heat required—makes lasting repairs. Order Smooth-On No. 1 from your supply house. Sizes from 7-oz. up. If they haven't it, contact us.

FREE Famous Repair Handbook

1895-1945
Half a Century of Dependable Service

Over 1,000,000 in circulation. Describes industrial and home repairs of endless types. 40 pages. 170 diagrams. Pocket size. Handy index. Every engineer and maintenance man should have it. Send coupon for your copy.

Mail This Today

Smooth-On Mfg. Co., Dept. 30,
570 Communipaw Ave., Jersey City 4, N. J.

Please send me my copy of the Smooth-On Repair Handbook

Name.....

Address.....

6-45.....

Do it with SMOOTH-ON

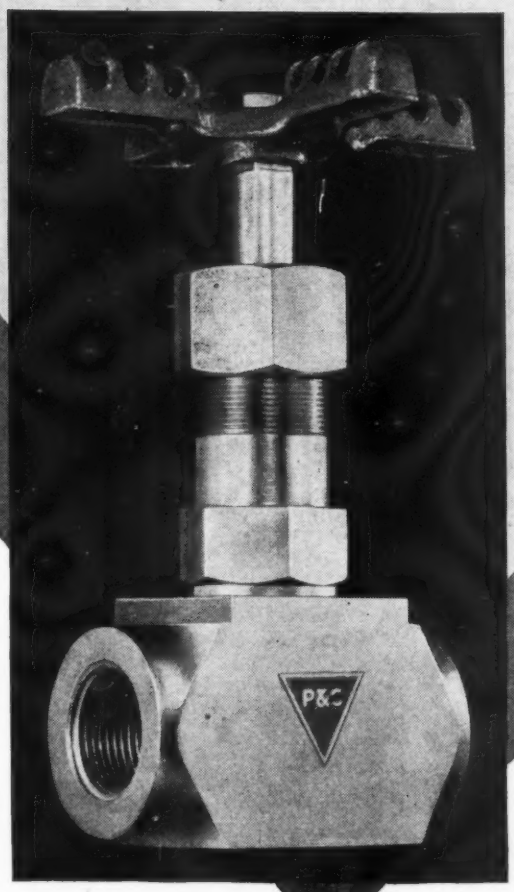
The Iron Repair Cement of 1000 Uses

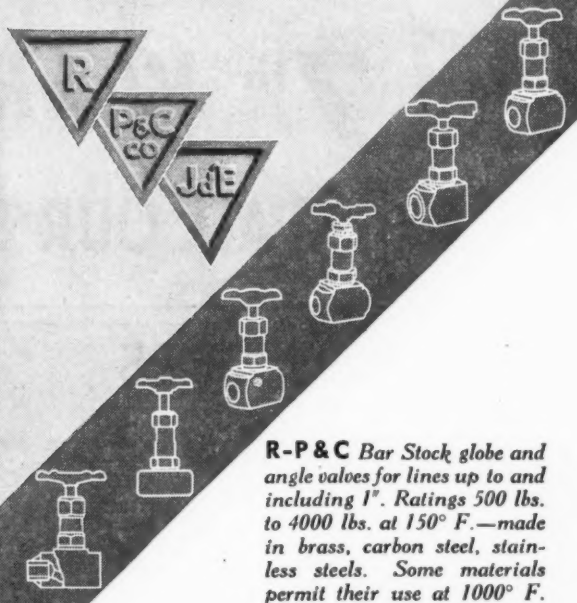
There's a Story behind this fine Valve

It is designed for severe throttling service. It is precision-made of rigidly controlled materials—for high working pressures. It is a Bar Stock valve—originated, developed and improved by **R-P&C** engineers. But that is only a part of the story.

This fine valve is one of a line that is still made under the "high working pressure" of wartime demands—in spite of the "severe throttling" of wartime shortages. And yet these Bar Stock valves are the best ever produced by **Reading-Pratt & Cady.**

It is a fact that **R-P&C** are making better valves today than ever before. We believe that's worth remembering next time you need valves.





R-P&C *Bar Stock globe and angle valves for lines up to and including 1". Ratings 500 lbs. to 4000 lbs. at 150° F.—made in brass, carbon steel, stainless steels. Some materials permit their use at 1000° F. (475 S.W.P.) Compact and sturdy for their ratings—low in price for their superior performance and long life.*

R-P&C offers you a single responsible source for bronze, iron and steel gate, globe, angle and check valves—cocks and Lubrotite gate valves—bar stock valves—cast steel fittings—D'Este Automatic Valves and Engineering Specialties.

READING-PRATT & CADY

MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa. • Atlanta • Boston • Chicago • Denver • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

ACCO

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

MANZEL CHEMICAL FEEDERS are Simple, Accurate, Dependable

The sturdy, simple construction of Manzel Chemical Feeders is one reason for their positive, dependable operation. Only the pumping unit comes in contact with the chemical. All drive mechanism runs in oil in a separate compartment.

Manzel Feeders are installed directly on the boiler feed water pump and start, stop, speed up and slow down with it. Feed may be adjusted while the pump is operating and is very accurate. Boiler compound goes farther and does a better job when injected by a Manzel Feeder.

Write for Bulletin

MANZEL BROTHERS COMPANY, 326 Babcock St., Buffalo 10, N. Y.

BUY ALL THE BONDS YOU CAN FOR THE 7th WAR LOAN

HELP BRING ALL OUR BOYS HOME SOONER!

1576 ENGINE HOURS

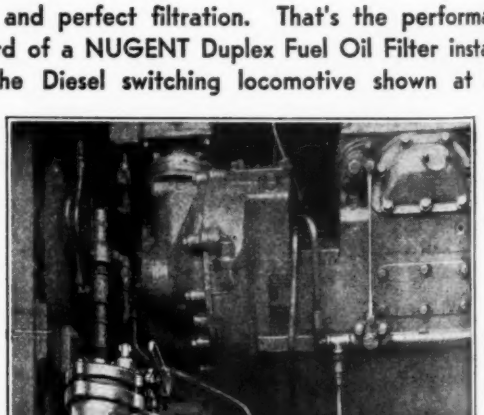
. . . on one recharge set

"No. 901"—a 900 h.p., 2 cycle Diesel switcher moving variable loads around curves and up and down ramps—recently operated 1576 engine hours without replacing the absorbent filter recharge in its Nugent Duplex Fuel Oil Filters. During this time 283,680 gallons of fuel oil were filtered and the engine consumed 8,012 gallons. The balance of the oil was by-passed back to the storage tank.

That's the kind of filtering that means maximum Diesel engine efficiency and the ultimate in oil conservation.

Get full details on the complete line of Nugent Fuel and Lube Oil Filters . . . write for Bulletin No. 7A.

. . . and perfect filtration. That's the performance record of a NUGENT Duplex Fuel Oil Filter installed on the Diesel switching locomotive shown at left.

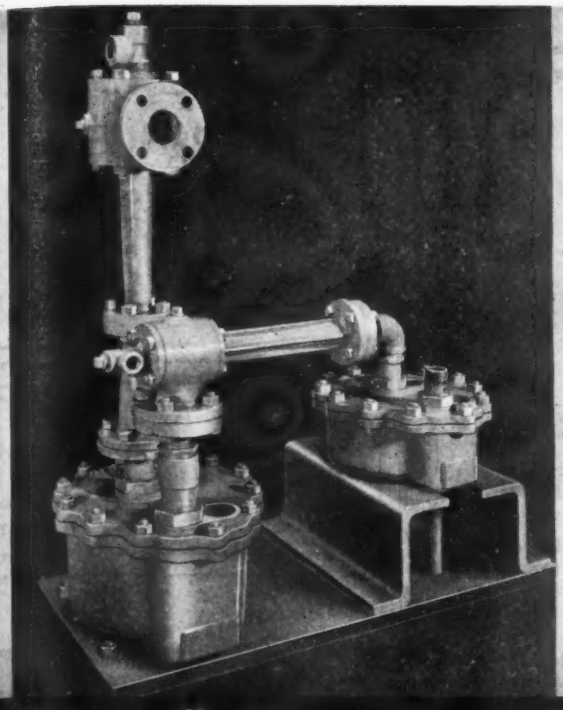


The above view shows the Nugent Duplex Fuel Oil Filters installed in the Diesel locomotive shown at the left. The throw away type filter recharge used in these filters is easily and quickly inserted in the filter cage, assuring the user of constant, thorough filtering.

NUGENT TRADE MARK

WM. W. NUGENT & CO., INC.
EST. 1897
402 N. HERMITAGE AVE., CHICAGO 22, ILL.

NUGENT FILTERS



THE IMPROVED GRAHAM STEAM JET EJECTOR

with new nozzle contour to provide desirable economies and characteristics . . . that render it a truly all purpose unit.

These ejectors are built in any size and for all ranges of suction pressures.

We solicit your inquiries on the basis of ten day delivery for some sizes.

An Improved Type, All Purpose Steam Jet Ejector, by Graham

MASTER CRAFTSMEN BUILD GRAHAM STEAM JET EJECTORS

All parts are then checked with complete micrometer and "go" and "no go" gauge equipment . . . by a staff of inspectors who function independently of shop management. Each part has to pass a precision standard before finding its way into a Graham assembly.

When you buy Graham you buy fine workmanship plus twenty-five years of "know how".

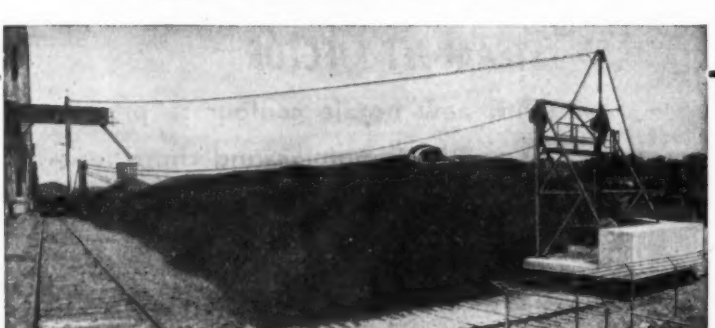
AWARDED THE MARITIME "M" PENNANT AND VICTORY FLEET FLAG APRIL 8, 1944

GRAHAM MANUFACTURING CO., INC.

415 LEXINGTON AVENUE • NEW YORK 17, N. Y.

Coal Handled at Low Cost

with a simple SAUERMAN SCRAPER installation



Managers of power plants large and small where coal is stored and reclaimed with Sauerman Scrapers say that this system is "tops" for fast, clean, economical handling of coal.

First cost of the equipment is reasonable. Maintenance is simple. Power requirements are moderate in relation to tonnage handled. Labor problems are eliminated by bringing the entire operation under "push button" control of one man. Very little engineering will prepare any site for a Sauerman installation and the available space, whatever its shape, always is utilized to best advantage by this system.

Moreover, safety of the stored coal is assured because the scraper stacks the coal in horizontal layers, producing a pile that is homogeneous and practically immune to spontaneous combustion.

Write for free copy of Coal Storage Manual

SAUERMAN BROS., INC.

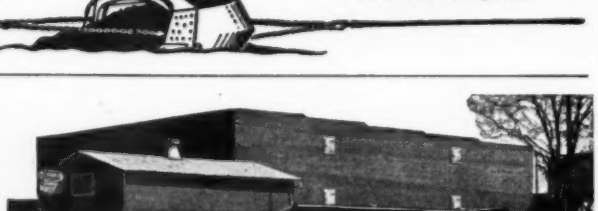
562 S. CLINTON ST. CHICAGO 7, ILL.

Fruit Storage

Refrig. Food Lockers

Frozen Food Storage

Chilling Meats



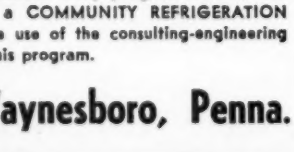
How this plant serves a town of 2500 as the Community Refrigeration Center

An ice plant of only 10 tons capacity a few years ago, the Greencastle (Pa.) Ice and Cold Storage now handles up to 80 tons daily, sells ice refrigerators, supplies farmers with ice for cooling milk, chills 600 tons of cherries in ice water before pitting, ices many refrigerator cars. ● It stores 100,000 bushels of apples, and freezes big hogsheads of peaches and berries, all from its own packing house. ● Meats, poultry, vegetables, and cream are frozen and stored. Twelve hundred refrigerated lockers are rented. Fresh-killed calves and sheep (4000 per month) are chilled before being shipped. ● The ice cream bar sells lunches; a cold room serves as a milk substation; beer was formerly handled at wholesale. Quick-freezing of locally grown foods in great quantity is the next step. ● We believe every progressive town can profit, in the postwar world, from a COMMUNITY REFRIGERATION CENTER. You are welcome to make use of the consulting-engineering service and equipment we offer for this program.

Frick Company, Waynesboro, Penna.

Milk Substation

Ice Delivery



Ice Cream Bar

PROFESSIONAL SERVICES

Consulting **Operation**
Constructing **Planning**
Designing **Testing**
Appraising **Analyses**
and other Power-Field Services

THE BIRD-ARCHER CO.

Engineers and Consultants on Water Conditioning Problems

Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. New York, N. Y.

H. E. CORL

CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plants Surveys Appraisals Reports
1316 Arch Street Philadelphia, Pa.

GILBERT ASSOCIATES, INC.

ENGINEERS AND CONSULTANTS
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examination—Laboratory
Industrials and Utilities
61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

HALL LABORATORIES, Inc.

R. B. HALL, Ph.D. Director
CONSULTANTS ON
BOILER WATER CONDITIONING
Hagan Building Pittsburgh (30), Pa.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION

CONSULTING ENGINEERS
Design Operations
Steam - Hydraulic - Gas
231 S. LaSalle St., Chicago (4), Ill.

CALL IN A SPECIALIST TO SOLVE THAT PROBLEM

Experiment takes time — so why not save time by calling in a specialist who has already gone over the ground you are now exploring?

POWER, meeting place of power men in all parts of the country, points the way to the solution of many power problems through its Professional Service Section.

Why not tell one of these specialists about your problem?

PROFESSIONAL SERVICES

Consulting — Operation
Constructing — Planning
Designing — Testing
Appraising — Analyses
and other Power-Field Services

SANDERSON & PORTER
Engineers - Constructors
FINANCING — REORGANIZATION
DESIGN — CONSTRUCTION
of
INDUSTRIALS and PUBLIC UTILITIES
Chicago — New York — San Francisco

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

J. E. SIRRINE & COMPANY
Power Plants — Consultation
Design — *Engineers* — Reports
Water — Steam Utilization — Plans
Greenville — South Carolina

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

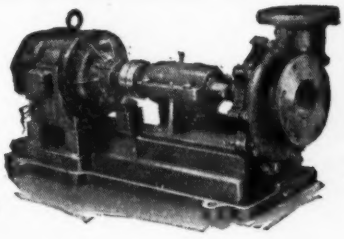
JOHN A. STEVENS, Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants — Paper Mills
Dye Houses — Surveys
Lowell, Massachusetts

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals
80 Broad Street, New York 4

WHITMAN, REQUARDT AND ASSOCIATES
Engineers — Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street — Baltimore 2, Md.

YOU CAN *RELY ON* FREDERICK...



The design and manufacture of centrifugal pumps for any industry has been our business for over 25 years.

Your industry has certain requirements which a pump must fulfill if it is to do a satisfactory job. Frederick pumps are built for your industry—from a basic design—and they are guaranteed to do the work for which they are sold.

Just give us this data . . .

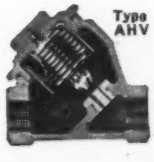
√ Describe the conditions under which your pumps must work—
√ Outline the type of work your pumps must do.

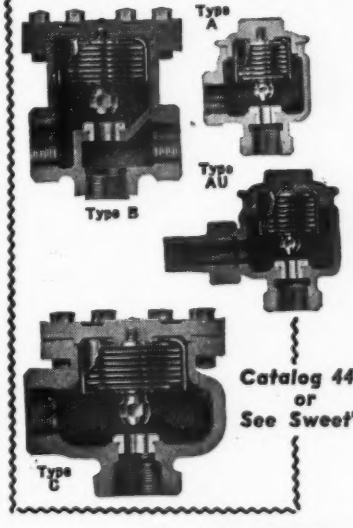
There is an answer to your pumping problems, and Frederick has that answer.

We will recommend a Frederick Pump which in design and operation will exactly meet your specific needs. Write today . . . engineering consultation available — with no obligation.

THE Frederick IRON & STEEL CO.
Frederick, Maryland
OVER 25 YEARS' EXPERIENCE BUILDING FINE PUMPS

Speed Up STEAM CIRCULATION WITH NICHOLSON





INDUSTRIAL THERMOSTATIC TRAPS

Here are six big reasons why Nicholson Steam Traps have outstanding records for promoting better steam circulation and heat transfer:

1. **NO AIR-BINDING. Discharge air as efficiently as water.**
2. **NO FREEZE-UPS. Of thermostatic bellows type; drain completely when cold.**
3. **NO DRIBBLING. Close immediately when steam contacts bellows.**
4. **NO ADJUSTMENT NEEDED, from vacuum up to maximum pressure.**
5. **NO WATER-LOGGED UNITS. A few degrees change opens valve.**
6. **BIG DISCHARGE CAPACITY, 2 to 6 times that of average traps.**

Five types; sizes ¼" to 2". Pressures to 225 lbs. For more details write for Bulletin No. 544.

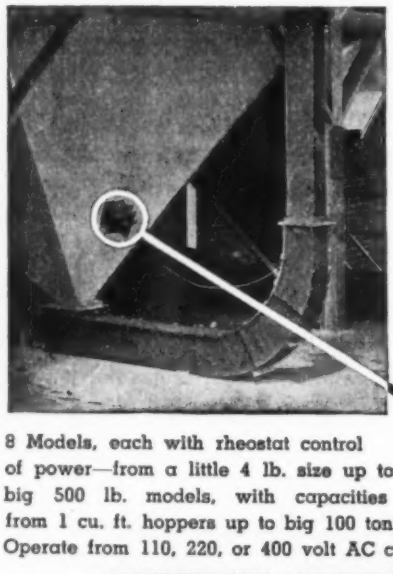
Catalog 444 or See Sweet's

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.
Valves • Traps • Steam Specialties

SYNTRON
"Pulsating Magnet"

ELECTRIC VIBRATORS

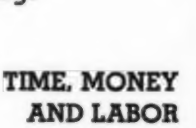
MAKE STUBBORN, WET COAL FLOW FREELY THRU BINS, BUNKERS & CHUTES



3600 powerful "Electronic - Controlled" vibrations per minute, break down arching and plugging—without damage to prime equipment.

Eliminate pounding and sledging.

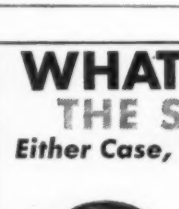
SAVE—
TIME, MONEY AND LABOR



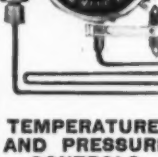
8 Models, each with rheostat control of power—from a little 4 lb. size up to big 500 lb. models, with capacities of from 1 cu. ft. hoppers up to big 100 ton bins. Operate from 110, 220, or 400 volt AC current.

SYNTRON COMPANY
492 LEXINGTON AVE. HOMER CITY, PA.

WHAT THE HEART IS TO LIFE
THE SWITCH IS TO A CONTROL
Either Case, When One Fails All Else Ceases To Function



TEMPERATURE AND PRESSURE CONTROLS



EXPLOSION PROOF CONTROL

LIQUID LEVEL CONTROLS

As long as the blood stream is permitted to flow through the heart, the human machine goes on, fulfilling its destiny. Likewise, as long as the electrical current is permitted to flow through the switch the control fulfils its designed purpose in whatever automatic heating or industrial application it may be used with.

The relative importance of a switch is sometimes overlooked, especially in an automatic control. In the event of a switch failure, as in the case of a boiler pressure or temperature limit control, as well as other important applications, the failure may prove hazardous and costly. That is why from the very beginning, Mercoid Automatic Controls were equipped exclusively with the now famous hermetically sealed Mercoid mercury switches, known and used the world over. They provide an electrical contact designed for millions of perfect operations—one reason why Mercoid Controls are noted for their long life and better performance. Mercoid switches are immune to dust, dirt, moisture or corrosion. They are not subject to open arcing, pitting or sticking of the contacting surfaces. That is the reason why Mercoid Controls are following the Army in some of the far outposts where adverse and extreme humid weather conditions exist.

There are many other important features incorporated in Mercoid Controls, but in the meantime, remember the all-important Mercoid Switch—the unfailing heart of Mercoid Controls.

THE MERCOID CORPORATION, 4221 BELMONT AVENUE, CHICAGO 41, ILLINOIS

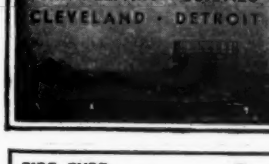
MERCOID DA CONTROLS
FOR THOSE TEMPERATURE OR PRESSURE CONTROL PROBLEMS

WHERE TO BUY

Featuring additional products and specialties for power plants

CHIMNEYS
Industrial Waste Burners
AMERICAN CHIMNEY CORP.
141 Fourth Ave.
New York City
BRANCHES: BOSTON
PHILADELPHIA - BUFFALO
CLEVELAND - DETROIT

FIRE TUBE MODEL



QUICK TUBE CLEANING
SAVE COAL
by
removing scale from boiler tubes. Use a VIBRATAP — the Vibratory Cleaner that dislodges the full thickness of the deposit and does a really complete cleaning job. Write for Bulletin K-7.
BRUNT EQUIPMENT CO.
60 S. DIVISION ST. • BUFFALO, N. Y.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

POWERS TEMPERATURE and HUMIDITY CONTROL
Automatic Control
For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2721 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

SEARCHLIGHT SECTION

POSITIONS VACANT

WANTED: FUEL Engineer for 12,000 H.P. High pressure boiler plant located in Northern Ohio. Technical graduate with several years experience preferred. Assume full responsibility for the selection and testing of coal. Good prospects for advancement in a long established, stable, and growing company. Liberal starting salary for qualified engineer. All replies strictly confidential. P-824, Power, 520 N. Michigan Ave., Chicago 11, Ill.

FIRE PROTECTION Engineers and inspectors. Technical graduates, especially chemical and electrical; civil, mechanical, metallurgical also considered. Inspect and consult industrial plants to prevent fires, explosions, and other casualties. Considerable travel and report writing; interesting work offering permanency. Engineering experience necessary. Salary open. Well-known national organization with openings at Cleveland, Chicago, and other district centers. Men under 34 years of age cannot be considered. Please send a photograph when applying. P-836, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: MECHANICAL and structural designer-draftsmen, thoroughly experienced in steam-electric power plant design and including piping and other related detailing. Work on drafting board. Send synopsis of training and experience including references, representative samples of design and draftsmanship, salary desired and earliest date could report for employment in Consulting Engineer's office. Location North Carolina. WMC regulations apply. P-838, Power, 330 W. 42nd St., New York 18, N. Y.

CHIEF DESIGN Engineer for old established valve manufacturer of automatic control equipment, permanent position as head of engineering department, advise age and qualifications. P-847, Power, 330 W. 42nd St., New York 18, N. Y.

GRADUATE MECHANICAL Engineers. Experience computation of heat balances, economic study of steam cycles and steam power plants for utility and industrial applications. Some experience in determining plant investment and electric energy and steam production costs desirable. Opportunity to develop parallel experience in engineering design or power plants. Location New York. Reply must give full particulars as to age, education, experience in detail, availability, draft status, salary, etc.; attach photograph which will not be returned. P-849, Power, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 367)

ENGINEERING EDITOR

M E GRADUATE

PREFER man about 40 with SOME PRACTICAL ENGINEERING EXPERIENCE. Position consists of preparing Booklets dealing with Lubrication of various types of machinery. PERMANENT POSITION Major Oil Co. Located in N. Y. C.

STARTING SALARY $5000

Give full details including Age, Experience, Education.

Box S-901, Finneran, 1475 B'way, N. Y. 18

WANTED

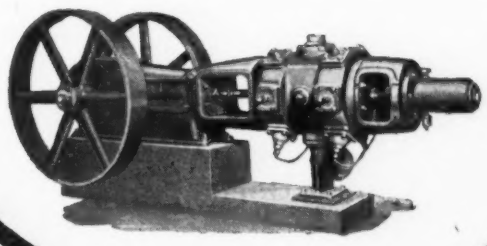
Factory Superintendent

(Plant in New York City Suburb)

To take complete charge of maintenance and repair of all equipment, buildings and Power Plant. Working knowledge of medium pressure steam, electricity, water, essential. Knowledge of Diesels preferred but not necessary. Ability to direct men (staff of 6) to get results and build good will. Unusual opportunity for further advancement. Salary $5000 start. Write complete details of Qualifications and work history.

P-843, Power
330 W. 42nd St., New York 18, N. Y.

(Additional Position Vacant ads on pages 366, 367 and 368.)



OILFREAIR COMPRESSOR

FEATURES:

Carbon piston rings entirely eliminate oil or grease lubrication of cylinder.

Carbon metallic type packing used in both cylinder stuffing boxes, dispensing with lubrication at these points.

Compressed air absolutely free from any trace lubricating oil.

Special tail rod bearing supports piston so that wear on carbon rings negligible.

Carbon rings guaranteed for 2000 operating hours without replacement.

Timken roller main bearings.

PPC

PENNSYLVANIA PUMP & COMPRESSOR CO.

BUSHKILL PARK ROAD, EASTON, PENNA

A NOTE of PROGRESS
... Based on Specialization

THE NAME *Lonergan* first appeared on safety devices nearly 75 years ago. Through the years—steady growth—then the war!

To make the thousands of tons of *Lonergan Safety Valves*, *Relief Valves*, and *Pressure Gauges* needed for war purposes, expanded facilities were necessary. (Note our new front door.)

But Lonergan growth is more than a war phenomenon. It is based on specialized engineering . . . improved designs . . . challenging new ideas . . . with all of these things linked to long-time traditions of customer-service.

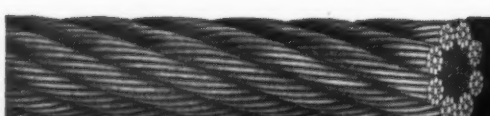
We'd like to serve you—and will welcome the opportunity to submit our recommendations on your next inquiry.

J. E. LONERGAN COMPANY, Race and 2nd Streets, Philadelphia 6, Pa.

Lonergan

Safety Valves • Relief Valves
Pressure Gauges • Specialties

SINCE 1872 — *Makers of Pressure-Safety Appliances for the Power, Mechanical, and Process Industries*



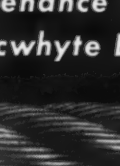
8 x 19 Macwhyte Special Traction Steel, PREformed or Non-PREformed

FOR SAFETY, DEPENDABILITY, ECONOMY...

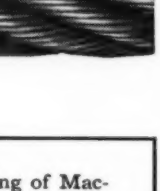
Ask your Elevator Maintenance Man for Macwhyte Elevator Ropes

6 x 19 Macwhyte Traction Steel, PREformed or Non-PREformed

- Made of selected steels—high quality and reliable for elevator ropes.
- Wire is drawn in Macwhyte's own mill under complete metallurgical control.
- Both PREformed and Non-PREformed types—smooth running, very flexible.
- For quick service your Maintenance Man can get the correct rope from Macwhyte Distributors or Mill Depots.



Complete listing of Macwhyte Elevator Ropes in handy, vest pocket size. Ask for Elevator Catalog E-9.



MACWHYTE COMPANY
2944 Fourteenth Avenue
Kenosha, Wisconsin

NO. 821-E

Specify MACWHYTE ELEVATOR ROPES

Low-Cost-Per-Car-Mile Ropes correctly designed for your Elevators

VIKING

Has Completed 34 Years Building the Most Popular ROTARY PUMP On The Market

Fig. 12

5-10-18-20-35-50-90 GPM capacities—other Motor drive units from ½ to 1050 GPM.

HERE ARE THE REASONS:

- Only 2 moving parts, each self-supported.
- Large sealing surface eliminates rapid slippage from wear.
- No small gadgets requiring frequent replacement.
- No pulsation.
- Self-priming.
- Delivers against discharge pressures.
- Low power requirements.
- Low speed—longer life.

VIKING PUMPS — FIRST IN AMERICA

For complete information about Viking Rotary Pumps widely used today in the power equipment field, write for Bulletin Series 800. It's free and will be sent to you by return mail.

VIKING Pump COMPANY
CEDAR FALLS, IOWA

WANTED

ENGINEERING EDITORS

TO expand its staff for greater postwar service to the power field POWER will engage two additional editors. Only men of well rounded abilities will be considered.

Basic requirements include engineering degree or equivalent, thorough understanding of engineering fundamentals, first-class character and personality, an intensely practical viewpoint, ability to express oneself clearly and work smoothly with other people in the New York office and on frequent field trips, substantial practical experience with utility or industrial power plants.

The industrial - plant experience should include one or more of the following power specialties: pumping, electrical services, mechanical power transmission, diesels, heating and air conditioning, refrigeration, compressed air.

Both men must be under 45, preferably under 37. Previous writing experience helpful but not essential if can demonstrate aptitude for clear, straightforward engineering presentations.

For men of the right stuff these positions offer stimulating creative work, broad contacts with the engineering world and a real opportunity for personal advancement.

Mail complete data, photo and extensive general comments to

Philip W. Swain, Editor, POWER
330 West 42nd St., New York, N. Y.

SEARCHLIGHT SECTION

POSITIONS VACANT

(Continued from page 365)

GRADUATE MECHANICAL Engineers. Large and small power plants. Experienced engineering, designs, specifications, cost estimates, heat balances, economic studies and preparation reports. Ability direct assistants. Location New York City. Give particulars, age, education, experience in detail, availability, draft status, salary, etc. Submit photograph which will not be returned. P-848, Power, 330 W. 42nd St., New York 18, N. Y.

CHEMIST OR chemical engineer experienced in boiler feed water treatment, to be in charge of analytical control laboratory in reliable midwest heavy chemical plant. Permanent job with opportunity for advancement. Salary commensurate with experience and ability. Give full details regarding training, experience, salary expected, and personal data, including age, in first letter. P-851, Power, 520 N. Michigan Ave., Chicago 11, Ill.

ASST. ENGINEER Wanted: Familiar with power plants of large cold storage warehouses using ammonia and brine circulation. Not necessarily licensed. Fundamentals of refrigeration required. A fair draftsman. Age about 38. Write stating experience and salary. This job offers a good future. P-852, Power, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 35 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo 2, N. Y.

(Continued on page 368)

WANTED

Project Engineer

Engineering and contracting firm catering to petroleum, gas, chemical and power industries needs chemical or mechanical engineers to be responsible for complete projects from flow sheets to termination of construction. Must cooperate with process engineers, drafting room, purchasing department and construction division and aggressively coordinate work through these departments. Must be proficient in thermodynamics, instrumentation and know mechanical equipment. Salary commensurate with ability. Location, Kansas City, Missouri. Applicants must have U.S.E.S. clearance.

P-821, Power
520 N. Michigan Ave., Chicago 11, Ill.

MACHINE DESIGNERS

Mechanical designers, electrical designers, and piping layout men, with industrial experience, needed by large national manufacturer.
Excellent postwar opportunities offered.
War Manpower Commission regulations must be observed.
Write details of experience, age, draft status and salary requirements to

P-846, Power
330 West 42nd St., New York 18, N. Y.

DRAFTSMEN WANTED

for both Centrifugal and reciprocating pump work. Permanent positions and desirable working conditions. Experience in pump work preferred but all applicants will be considered.

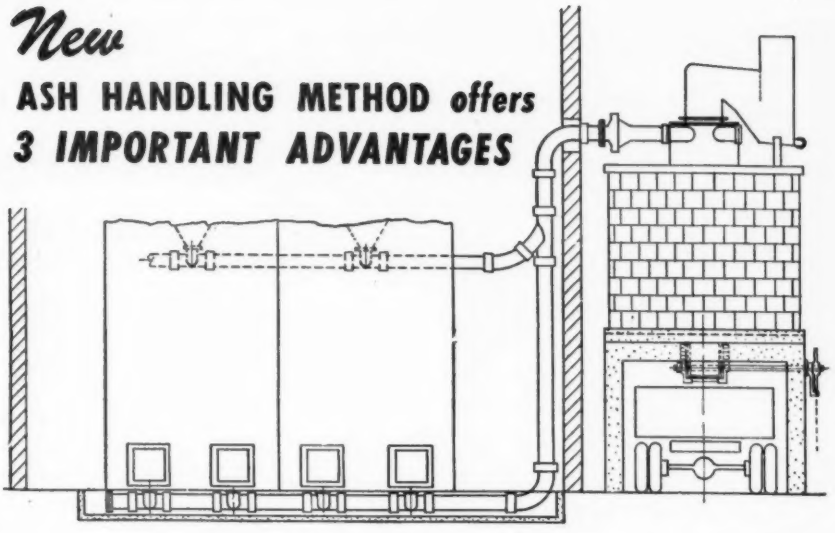
WARREN STEAM PUMP CO., INC.
WARREN, MASS.

MECHANICAL DESIGNERS

Experienced in Power, Industrial, and Processing Plants.

EBASCO SERVICES, INC.
2 Rector St. N. Y. C. 6

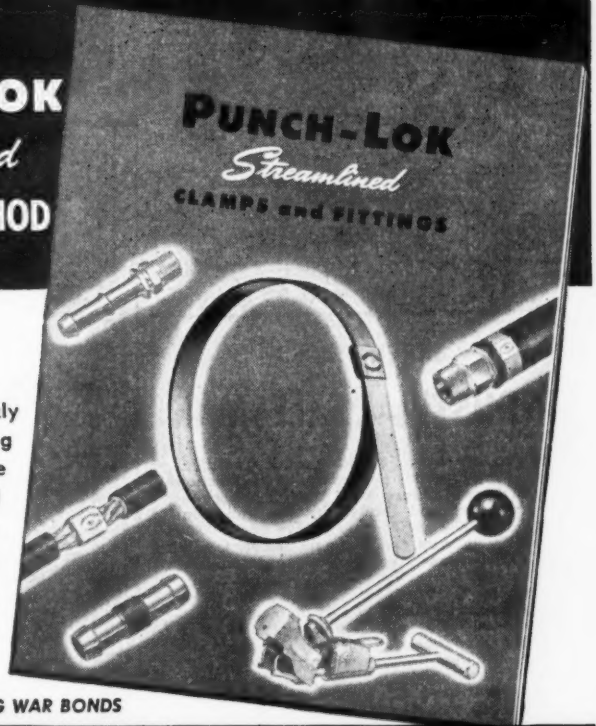
New
ASH HANDLING METHOD *offers*
3 IMPORTANT ADVANTAGES



In the Beaumont "Vac-Veyor" pneumatic ash handling system the exhauster, receiver, separator and air washer are combined as one unit. Operating advantages include: (1) All ash delivered into the silo, none into the air. (2) Ashes delivered practically dry, which minimizes the possibility of packing or freezing in the silo. (3) Continuous operation, with low steam consumption. What are your ash handing problems? Send today for literature.

BEAUMONT BIRCH COMPANY
1502 RACE STREET PHILADELPHIA, PA.
DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS

Clamp-Splice-Tie-Mend-Reinforce
with
PUNCH-LOK
Streamlined
BANDING METHOD



Punch-Lok Clamps, quickly applied with the Loking Tool, save money and time in your production and maintenance operations. Send now for descriptive catalog and name of nearest distributor.

KEEP BUYING WAR BONDS

PUNCH-LOK COMPANY
Dept. P, 321 No. Justine St., Chicago 7, Illinois

POSITIONS WANTED
(Continued from page 367)

ELECTRICAL ENGINEER wishes to make connections where full use can be made of over fifteen years experience in electric control, power, industrial electronics, communication, and radio. Will be available after July 1st. PW-853, Power, 330 W. 42nd St., New York 18, N. Y.

ENGINEER WITH 25 years experience operation of steam power plants, electric distribution and water systems. Now employed as superintendent of utility property with steam power plant of 3500 kw capacity. Reason for change, locality. Prefers position in South or East central states. University graduate. Registered professional engineer. PW-842, Power, 520 N. Michigan Ave., Chicago 11, Ill.

CHIEF ELECTRICIAN now with large Northwest utility desires connection with industrial company in one of the following capacities, supt. of maintenance, plant engineer, manufacturers representative, electrical or mechanical sales engineer or chief electrician. Twenty-five years technical and practical experience, electrical and mechanical construction, plant maintenance, electrical and mechanical design, sales engineer, mechanical or electrical lines. Min. salary considered $4200.00, age 48, must be permanent. PW-854, Power, 68 Post St., San Francisco 4, Calif.

SALESMAN WANTED

SALESMAN WANTED: Salary, commission and office for qualified full time representative in New York or Chicago. Active accounts established. Applicant must be experienced and thoroughly familiar with centrifugal pumps or steam turbines. Engineer preferred. Write fully, confidential. Dean Hill Pump Company, 4000 E. 16th St., Indianapolis 7, Indiana.

SALESMAN AVAILABLE

YOUNG MAN is looking for opportunity to become associated with a manufacturer or local sales agency in employment leading to position of salesman in eastern territory—power equipment preferred. High school plus 1 year college (math). Personable. Automotive mechanical experience. Honorable Army discharge. SA-855, Power, 330 W. 42nd St., New York 18, N. Y.

REPRESENTATIVE AVAILABLE

GRADUATE MECHANICAL Engineer: Six years experience in power plant field—piping layout, design, instrument servicing; for past two years head marine engineering department largest private merchant marine officers training school in U.S.A. Desires to contact power plant equipment manufacturers with aim of becoming sales engineer or representative as soon as WMC restrictions are lifted. Sufficient spare time now available to thoroughly study your product or cooperate fully with your New York office. RA-850, Power, 330 W. 42nd St., New York 18, N. Y.

FOR SALE

1—THOMPSON Steam engine indicator in good condition. Only used about 12 times. Has oak cabinet. Make offer. FS-856, Power, 330 W. 42nd St., New York 18, N. Y.

EXPERIENCED

INDUSTRIAL SALESMAN

If you are over 38 with proper qualifications and seek a permanent connection with a real future with one of the country's recognized leaders in the industrial maintenance field we offer you: $50 weekly guaranteed drawing account with a contract assuring attractive income. Established territory. Nationally known line vital to war interest. No shortages or priority problems. Protection on repeat business. Our men make from $6000 to $9000 per year and more. Our products are essential because they maintain wartime plant efficiency and will be equally important after the war. The service rendered by our men is considered essential. They receive gasoline and tires needed. Write full details stating products sold for Personal interview.

THE NORTH AMERICAN PRODUCTS COMPANY
Cleveland 13, Ohio

ENGINEERS and DRAFTSMEN

Electrical—Mechanical—Structural

We have openings for capable engineers and draftsmen in the following branches of engineering—

ELECTRICAL—Industrial lighting, Power distribution, and Electronic controls and devices.

MECHANICAL—Power plants, Heating systems, Process piping, Conveying systems, Plumbing, Sewers, Sprinkler work, and Precision machine design.

STRUCTURAL—Industrial buildings, Power plants, and Miscellaneous structures of steel and reinforced concrete.

Opportunities are in the West Coast, Cleveland, Chicago, New York and Gulf Coast areas.—Vital war plants important to the United States Government under high priority ratings.—Recent graduates will be considered.

Applicants must conform with Local War Manpower Regulations.

THE AUSTIN COMPANY
National Headquarters
16112 EUCLID AVENUE CLEVELAND, OHIO

Are You Looking for METERS

VOLTMETERS, AMMETERS, MILLIMETERS, MICRO AMMETERS, OHMMETERS, FREQ. METERS, BRIDGES (Wheatstone), MEGOHMMETERS, RHEOSTATS, VARIABLE TRANSFORMERS, RELAYS

Ask for Our Latest Availability List

ELECTRO-TECH
EQUIPMENT COMPANY
329 Canal St., New York 13, N. Y.

INSTRUMENTS REPAIRED
REBUILT AND RECALIBRATED
Large List of Used Switchboard, Indicating and Recording Instruments on hand.
ENGINEERING EQUIPMENT CO.
2130 Fairmount Ave. Philadelphia, Pa.

UNIVERSAL TOOLS: NATIONALLY ADVERTISED BRANDS AND PRICES.
If it's Tools—We have it, Can get it, or it isn't made! *Price List & Order Blank Free!!*
UNIVERSAL TOOL COMPANY
O. B. Dematteis, President
1527 Grand CA, Kansas City, Missouri.
IMMEDIATE SHIPMENT: OVERNIGHT BY AIR: TO ANYWHERE—USA.

WANTED

Cash Ready
FOR YOUR
ELECTRICAL EQUIPMENT
Electric motors, AC and DC.
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment
Send us list with full details
WIRE OR PHONE
POWER EQUIPMENT CO.
154 ANDREWS ST., ROCHESTER 4, N. Y.
Telephone Main 568 or 569

WANTED
150 K.W. Synchronous Motor Generator Set 2300 V 3 Phase 60 Cycle to 230 V D.C. Panel board and starting equipment.
TEXTILE PRINTING COMPANY
BONDSVILLE, MASSACHUSETTS

WANTED
DIESEL ENGINES
Total 1600 HP required, with or without Generators. Consider units 225 HP and larger. Also smaller high speed units for standby service. Preference given units immediately available. Give complete details and price.
Address Purchasing Department
W-844, Power
330 West 42nd St., New York 18, N. Y.

"Opportunity" Advertising:
Think
"SEARCHLIGHT"
First

HI-LIGHTS OF *Hemphill* VALUES!

You can easily understand that we are doubly particular about equipment — for two reasons. First—We invest our own money in buying or acquiring control of equipment to sell to you. And — second — we cannot afford to lose customers (and our reputation) by selling a poor piece of equipment. So naturally the graduate Electrical Engineers on our staff make doubly sure that every piece of equipment we get—and sell—is GOOD EQUIPMENT.

FOR US- WE FOR YOU

DOUBLE-CHECK FOR VALUE

Our check on equipment value is YOUR biggest protection. That's a fact anyone can appreciate. So you get a double assurance of service,—when you invest in the equipment Hemphill has invested in!

The Hemphill SEAL OF QUALITY GUARANTEES ENGINEERED RECONDITIONING

MOTOR—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 1200 RPM, 220 volt, Westinghouse squirrel cage.
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
1—200 HP, 600 RPM, 2200 volt, G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl. rg.
1—150 HP, 400 RPM, 440 volt, General Electric squirrel cage.
1—125 HP, 1800 RPM, 2200 volt, Continental, squirrel cage.
1—100 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
2—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1— 90 HP, RPM, 550 volt, Cr. Whir., sq. cg.
1— 75 HP, 1200 RPM, 440 volt, G.E., slip ring.
1— 75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1— 75 HP, 720 RPM, 440 volt, Westghse. slip ring.
1— 75 HP, 1200 RPM, G.E., sl. rg.
2— 75 HP, 900 RPM, G.E., sl. rg.
1— 60 HP, 1200 RPM, 220 volt General Electric, slip ring.
1— 50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1— 50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—125 HP, 1170 RPM, G.E.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1— 75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.

MOTORS—D.C. 230 VOLTS (Con't.)

8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Tyve C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
1—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—18/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse.
1—10 HP, 400/1600 RPM, Westinghouse.
1— 5 HP, 600/1200 RPM, General Electric.
1— 5 HP, 450/1800 RPM, Crocker Wheeler.
1— 5 HP, 400/1600 RPM, Diehl.
1— 5 HP, 225/900 RPM, Electro Dynamic.

MOTOR GENERATOR SETS

1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1— 30 KW, 135 volt, Allis Chalmers non-condenser.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 2300 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chal.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E. 33000/2300/4000 Y.
2—100 KVA, General Electric 2200/220/440 volt.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200/250 volts.
3— 75 KVA, Westinghouse, 2200/220/110 volts.
3— 75 KVA, G.E., 13,500-750/440 volts.
1— 75 KVA, G.E., 3 phase, 4156Y—120/208Y.
2— 50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
2— 15 KVA, G.E., 2300-115/230 volts.
2—100 KVA, G.E., 2400/240/480.

GASOLINE DRIVEN D.C. GENERATOR SETS

2—25 KW, 125 volt.
1—30 KW, 125 volt.

It's Hemphill for Power!

J. L. HEMPHILL & CO.

Electrical Engineering and Equipment

OFFICE AND WAREHOUSE:
1601 53rd STREET
PHONE NEW YORK — LONGACRE 5-3227

NORTH BERGEN, N. J.
PHONE NEW JERSEY — UNION 3-2600

REMEMBER "U.E.M." FOR THE FINEST IN

POWER PLANT MACHINERY

Units listed available for immediate delivery

TWO COMPLETE POWER PLANT INSTALLATIONS

1 1000 KW 80% P.F.—1250 KVA, 3 phase, 60 cycle, 240 volt, 3600 RPM Elliott alternating current generator direct connected to a 1000 KW, 3600 RPM, 175 to 300 lbs. pressure straight condensing having bleeder opening for 7600 lbs. steam per hour and 10 lbs. extraction pressure, complete with exciter, switchboard panel and instruments, Elliott jet condenser, pumps, piping, valves and fittings. Installed new 1939, equivalent to new.

2 324 HP Babcock & Wilcox-Sterling water tube boilers, National code, 175 lbs. pressure complete with Taylor stokers and all auxiliaries. Excellent condition; new 1922.

1 500 KVA or 400 KW 80% P.F. Westinghouse, 3 phase, 60 cycle, 460 volts, 164 RPM alternating current generator direct connected to a 26"x28" Skinner horizontal Universal Unaflow, side-crank, bored-guide, left-hand poppet valve, heavy duty, full floating piston, non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure, complete with exciter, switchboard panel and instrument.

3 407 HP Wickes horizontal cross drum box header type water tube boilers built under ASME and National codes, 160 lbs. pressure, each complete with stoker and all auxiliaries. Two of these boilers are set in one battery and the third in a single battery. This plant is modern in type and constructon, and in first-class operative condition.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

3125 KVA G.E. 180-200 lbs. pressure, 500° TT, 2300 volts, 3600 RPM, equipped with surface condenser, condensing auxiliaries, exciter unit, switchboard with instruments (a complete installation).

1875 KVA G.E. condensing 175-200 lbs. pressure, 500° TT 6600 volts, 3600 RPM complete with condenser.

1500 KVA (2) General Electric, condensing 200 lbs. pressure, 550 volts, 3600 RPM complete with condensers, exciters, switchboard panels and instruments.

937 KVA G.E. condensing 150-175 lbs. pressure, 2300 volts, 3600 RPM with direct shaft exciter, surface condenser and auxiliaries.

780 KVA Westinghouse non-condensing 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

625 KVA Westinghouse non-condensing, 150-200 lbs. pressure, 35 lbs. gauge back pressure, 2300/480/240 volts complete with switchboard.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

125 KVA Westinghouse non-condensing, 175-200 lbs. pressure, 0-10 lbs. gauge back, 240 volts with direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle
Alternating Current

375 KVA Westinghouse 240 volts, 225 RPM generator direct connected to 440 HP, 4 cylinders Nordberg vertical Diesel engine.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17"x24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

312 KVA Westinghouse 240/480 volts, 200 RPM generator direct connected to Skinner Unaflow non-condensing engine.

SPECIAL OFFERINGS

1690 C.F.M. 110 lb. air pressure Ingersoll-Rand steam driven air compressor 125 to 150 lbs. steam pressure.

1590 C.F.M. 100 lb. air pressure Hardie-Tynes steam driven air compressor 150 to 175 lbs. steam pressure.

500 KVA G. E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

600 HP 90% P.F. 3 phase, 60 cycle, 2300 volt, 180 RPM Allis-Chalmers synchronous motor.

ENGINE-GENERATOR UNITS

Direct Current

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to Ames vertical Unaflow non-condensing engine.

125 KW 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse non-condensing turbine-generator unit.

75 KW 125 volt, 2400 RPM Allis Chalmers Terry non-condensing turbine-generator unit.

15 KW (3) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an American Blower vertical engine.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3-phase, 60 cycle, 2300 volts alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connecting to 1700 HP, 3 phase, 25 cycle, 2300 volt, 300 RPM synchronous motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

"BIG STUFF" *is no problem to* BELYEA

In the Belyea Shops we have facilities to dismantle, re-nu-build, test and ship the biggest type of electric power equipment (as well as the smallest). It is facilities such as ours (the result of 37 years service) that materially lower the cost of rebuilding, testing and handling. Thus the price you pay for GUARANTEED Belyea Re-Nu-Built equipment always represents the utmost value for every dollar invested.

3—1667 K.V.A. PITTSBURGH TRANSFORMERS 13200 to 2300 volt, 1 phase, 60 cycle, just recently shipped from Jersey City to customer. A duplicate bank is still available here.

Part list of Belyea Equipment—Successful Operation Guaranteed

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 250/375 V. D.C. to 2100 H.P., 2300 V.
1—1000 KW G.E., 250/275 V. D.C. to 1400 HP., 2300/4150 V.
1—1000 KW Whse., 600 V. D.C. to 2000 KVA, 2200 volt with exciter.
1—750 KW G.E. 250 v. D.C. to 1100 H.P. 2300/4150 v.
1—750 KW Whse., 275 V. D.C. to 1100 H.P., 2200 volt with exciter.
1—500 KVA—300 KW—220/440 V. A.C. Gen. to 500 H.P.—230 V. D.C. Motor.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—400 KW G.E., 250/275 V. D.C. to 650 H.P. 2300 V.
1—200 KW G.E., 125 V. D.C. to 300 KVA, 440 V. Syn. Motor with exciter.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
1—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.

3 Phase 25 Cycle

1—25 KW G.E., 125 V. D.C. to 35 H.P., 360 V. Motor.
1—75 KW Whse., 125 V. D.C. to 110 H.P., 440 V. Motor.
1—250 KW G.E., 250 V. D.C. to 285 KVA, 6600 V. Motor.

TRANSFORMERS—POWER AND DISTRIBUTION

60 CYCLE (Unless Otherwise Noted)

Qu.	KVA	Make	Ph.	Type	Voltages
3	1667	Pitts.	1	OISC	13800x2400
1	1050	G.E.	3	WCTH	11000x445/222½
4	525	G.E.	1	HJ	2300x445
4	500	Pitts.	1	OISC	13200x2300
2	333	Pitts.	1	OISC	2400x220
3	333	Maloney	1	C	22000/11000x2300/575
2	333	Whse.	1	OISC	2300x460
3	300	G.E.	1	HRP-25 cy.	13200x575/1150/2300
1	300	Pitts.	3	OISC	4150x208/120
1	200	G.E.	1	HLLD	27600x115/460
2	200	G.E.	1	HKDD	13800x220/440
1	200	Whse.	1	SK	6600x220/440
3	200	G.E.	1	HJ	2300x408/204
1	200	G.E.	2–3	Auto	2500x2500
1	200	G.E.	1	H	2300x115x230
3	100	G.E.	1	HJDD	13200x445/226
3	100	Whse.	1	OISC	13200x250
1	100	Whse.	1	OISC	11430x250
2	100	G.E.	1	A	2200x120/240
1	100	Whse.	1	SK	2300x115/230
2	100	Pitts.	1	OISC	2300x115/230

A.C. MOTORS

3 Phase 60 Cycle

SLIP RING

Qu.	HP	Make	Volts	RPM	Desc.
2	100	G.E.	2200	575	IM
1	100	G.E.	550	685	MTC-5552
1	100	G.E.	550	720	IM
1	100	G.E.	220	1750	IM
2	150	G.E.	4000	585	IM-16
2	250	Whse.	440/2300	450	CW
1	250	G.E.	4000	257	MT-424Y
1	350	G.E.	4000/2200	253	MT-442Y
1	350	G.E.	550	490	MT-412Y
1	400	G.E.	2200	252	IP
1	400	A.-C.	2300	505	ANY
1	450	Whse.	2200	875	CW
1	500	Al. Ch.	2200	590	ANY-36
1	600	Cr. Wh.	2200	507	131-AQ
1	800	A.-C.	440	885	ANY
1	1200	C. W.	2300	237	801Q

SQUIRREL CAGE

Qu.	HP	Make	Volts	RPM	Desc.
1	100	Whse.	2200	580	CS
1	150	Whse.	550	400	CS-594A
2	175/112	G.E.	440	900/720	IK
1	200	G.E.	2200	490	IK
1	200	G.E.	550	580	IK
1	300	G.E.	440	900	IK
1	300	Whse.	550	580	CS

SYNCHRONOUS

Qu.	HP	Make	Volts	RPM	Desc.
1	75	G.E.	220	600	TS 7556
1	600	Al. Ch.	2300	720	
2	2100	G.E.	2200/4400	514	ATI

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed	Desc.
1	750	G.E.	220/440	900	ATI
1	1000	G.E.	2300/4100	900	ATI
1	2000	Whse.	2300	720	
2	2100	G.E.	2300/4600	514	ATI
1	3000	Al. Ch.	2300	900	
1	5000	Whse.	2300/4000	900	

3 Phase 25 cycle

1	75	Al. Ch.	440	750	ANY
1	150	G.E.	440	500	IM
1	200	G.E.	440	242	Sl. Rg.
1	300	G.E.	440	290	Sl. Rg.
1	390	G.E.	6600	750	ATI
1	1400	G.E.	2300	500	ATI

ROTARY CONVERTERS

3 Phase 60 Cycle

Qu.	HW	Make	Speed	Dc V.	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	720	250	22000
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
2	375	G.E.	1200	250	6600/2300
2	300	G.E.	1200	600	2300
1	300	Al. Ch.	1200	250	2400

3 Phase, 25 Cycle Booster Type

2	1500	G.E.	500/225/275/13200/6600
1	500	G.E.	750/225/275/13200/6600

All units can be furnished with AC and DC controls

D.C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	180
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
1	700	G.E.	MPC	250	220/440
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
1	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.		230	525
1	250	G.E.	C	230	375
2	200	Whse.	SK	230	400
1	175	Whse.	SK	230	150/525
1	150	G.E.	MPC	230	250/450
2	130	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625
1	100/150	Whse.	SK-200	550	600
1	100	G.E.	LC-50	230	1200
1	100	Whse.	SK-180	230	600
1	100	G.E.	RC-38	230	600
1	75/100	Whse.	SK-183	230	450/900
1	50/100	G.E.	MPC	230	225/450
2	75	Whse.	SK-183	230	500/1000
1	75	G.E.	C	230	500/1000
1	60	El. Dy.	255	230	525/1050
1	50/60	Cr. Wh.	CMC-65H	230	500/1000
1	50	G.E.	RC-19	230	400/1200
1	50	Cr. Wh.	CMC-80H	230	380/750
1	15/50	Cr. Wh.	CMC-81H	230	300/900

SUCCESSFUL OPERATION GUARANTEED
Quality without Question

BELYEA CO., INC.
Main Office and Shop
43 HOWELL ST., JERSEY CITY, N. J.

RE NU BILT BELYEA MOTORS

DEPENDABLE ELECTRICAL EQUIPMENT

Guarantee • • • The equipment will be furnished completely and thoroughly shop reconditioned, tested and guaranteed mechanically and electrically free from inherent defects; and if operated under normal conditions, with proper care and competent supervision, we will f.o.b. our plant, New York, N. Y., correct by repair or replacement at our option, defects occurring in this equipment within one year from date of shipment.

1 YEAR!

SQUIRREL CAGE MOTORS
3 ph. 60 Cy.

QU.	HP	Make	Type	Speed
1	200	G.E. 440 v.	IK	600
1	147	West. 25 cy.	CS	715
1	100	Al. Ch.		690
2	100	G.E. 440 v.	PTA564	375/750
1	85	G.E. 2300 v.	PT529	3600
1	75	El. Dy.	KNX505	1750
1	75	Burke		1150
1	50	G.E.	KT537	1750
1	50	Star	A75	1750
1	50	West.	CCL	1150
1	50	Al. Ch.		865
1	50	Cr. Wh.		865
1	50	Burke		690
1	50	West.	CS	690
2	45	W.E.		150/900
1	40	West.	CS	1760
4	40	El. Dy.	DNX444	1760
1	40	G.E.	KT	1150
1	40	Lincoln		1150
1	35	Wagner		850
1	35	West.	CS	690
1	30	U. S. Vert.	CPU907	3450
1	30	A-C		1150
1	30	Diehl		860
1	30	Cr. Wh.		870
1	30	Al. Ch.		870
1	30	G.E.	KT342	690
1	30	West.	CCL	690
1	30	G.E.	IK	514
1	25	Triumph		1750
1	25	G.E.	KT302	1750
1	25	Wagner 220v.	F-W	1200
1	25	Al. Ch.		1150
1	25	West.	CS	1150
1	25	El. Dy.	KMQ444	865
2	25	G.E.	IK	865
2	25	Diehl	I8167	865
1	25	West.	MS	860
1	25	Wagner 440v.	P-W	720
1	25/12½	G.E.	445	840/405
1	20	West.	CS365	3500
1	20	G.E.	PT312	1740
1	20	G.E. Vert.	PT501	1750
9	20	El. Dy.	KNX364	1750
1	20	F.M.	KMV12D	1150
2	20	G.E. Vert.	KT512	1150
1	20	Cr. Wh.		1150
1	20	F.&M.		1160
2	20	West.	CS	1160
1	20	G.E.	KT332	1160
2	20	Al. Ch.		860
1	20	F.M.		860
1	20	Diehl		860
1	20	West.	CS566	870
1	20	G.E.	KT326	870
1	20	G.E.	IK	690
1	20	West.	CS584	690
1	20	West.	CCL	690
1	15	West.	CS324	3500
2	15	G.E.	KF751	3400
1	15	Burke		1750
1	15	Wagner 220v.	P-W	1800
21	15	El. Dy.	326	1750
1	15	Lincoln		1150
1	15	G.E. Vert	KT502	1150
1	15	West.	CCL	1150
3	15	West.	MS	1150
1	15	West.	CS	1150
1	15	G.E. Vert.	IK	860
1	15	West.	CS	860
1	15	Wagner 440v.	F-W	720
1	15	G.E.	IK	720
3	10	G.E.	KT	3600
12	15	West.	CS 445	600/900 1200/1800

SQUIRREL CAGE MOTORS
2 ph. 60 cy. type

Qu.	HP	Make	Type	Speed
1	75	G.E.	IQ	1750
1	70	G.E. Synch.	AQI	1200
1	50	Lincoln		870
1	50	G.E.	IQ	870
1	40	Al. Ch..		870
1	40	F-M		870
1	35	Al. Ch.		870
1	30	West.	CCL	1150
1	25	G.E.	KQ312	1750
3	25	G.E.	ICL	1150
1	25	West.	CCL	1150
1	25	Burke		900
1	20	West.	CS	1160
1	15	F-M		1750
1	15	G.E.	KQ502	1150
1	15	West.	CS4	1150
1	15	G.E.	IQ	720

SLIP RING MOTORS
2 & 3 ph. 60 cy.

Qu.	HP	Make	Type	Speed
1	450	G.E.	MT412	506
1	250	G.E.	IM	580
1	150	El. Dy.	New	1770
1	100	G.E.	MTC5546	800
1	100	G.E.	IM	900
1	100	G.E.	IM	690
1	100	F-M	FA	690
1	75	G.E.	IM	1160
1	75	West.	RF	1160
1	75	Al. Ch.		865
1	75	Al. Ch.	ANY	575
1	65	G.E.	MTC552	585
2	60	Otis		1750
1	60	West.	CW648	1150
1	60	West.	CW950A	290
1	50	G.E.	Ig	870
1	50	Wagner		1150
1	40	F-M		870
1	40	West.	CW	870
1	35	Burke		690
1	40	G.E.	MT312	570
1	30	G.E.	MC332	870
2	30	G.E. 220 v.	MT542	690
1	25	West.	CW	1160
2	25	Al. Ch.	ANY20G	870
1	25	Burke	FMV3	870
1	25	Howell	SFS420	870
1	25	West.	CW748	575
2	15	G.E.	MT502	1150
1	15	West.	CW	870
1	15	Cleveland	MW147	870

A. C. GENERATORS

Qu.	KW	Make	Voltage	Speed
1	150	G.E.	220/440	600
1	150	Cr. Wh.	220/440	900
1	100	West.	220/440	600
1	35	Allen	220/440	900
1	35	Burke	220/440	720
1	50	Elec. Mchy.	220/440	900
1	25	West. 1 ph.	110/220	1200

A.C. TURBO GENERATOR

625 KVA Westinghouse Geared Turbine, 150 lbs., 35 lbs. back pressure 3 ph. 60 cy. 2400 Volt .8PF also driving

PLATER

7500 Amp. Electric Products 6/12 volt, 400 RPM. with 100 H.P. Gen. Elec. TS Syn. Motor with automatic starter.

230 V. D.C. MOTORS

Qu.	HP	Make	Type	Speed
1	350	West.	SK	340/425
1	150	West.	S	600
1	60	G.E.	LC	450/1160
1	60	El. Dy.	2SS	450/900
1	50	El. Dy.		900
1	50	West.	SK150	550/1100
1	45	Diehl		850
1	40	G.E.	DLC	1050
40	40	Cr. Wh.	CCM	915
1	35	West.	SK	1150
1	35	West.	SK120	975
1	35	G.E.	PLC204	440/880
2	35	West.	SK160	400/600
2	30	G.E.	CD83	3450
1	30	G.E.	RC	1150
1	30	West.	SA	975
1	25	G.E.	RC	1150
1	25	West.	SK	1150
1	25	Diehl	K8	850
1	25	Al. Ch.		850
1	25	Fl. Dy.		1500
1	25	G.E.	CD113	575
1	20	G.E.	CD83	1200/1600
1	20	R. & M.		1150
1	20	G.E.	RC	1150
1	20	El. Dy.		950
1	20	G.E.	RC	800
1	20	West.	SK110L	750
1	15	Rorb.	SV5	3450
3	15	G.E.	RC	1150
2	15	G.E.	CD	1150
1	15	G.E. Vert.	CD	900
1	15	West.	SK	850
1	15	G.E.	RC	850
1	15	West.	SK	600/2500
1	13	Diehl		200/247
1	10	G.E.	RF	450/1800
1	10	G.E.	CD	1150
1	10	West.	SK	400/1200
3	10	G.E.	RC	850
1	10	G.E.	CVC	700
1	10	Diehl		750
1	10	West.	SK	600/1200
1	10	El. Dy.		450/1800
1	10	G.E.	RF	400/1600
2	10	West.	SA	400/1200
1	10	G.F.	RF	450/1800
1	8½	Diehl		900
1	8½	West.	SK	850
1	8½	West.	SK90	350/1400
1	8	G.E.	RLC	500/1500
1	7½	G.E.	RC	1700
1	7½	G.E.	CVC	1525
1	7½	West.	SK	1450
3	7½	G.E.	RC	1150
2	7½	G.E.	RC	1150
1	7½	West.	SK	950
1	7½	Al. Ch.		850
1	7½	G.E.	RC	850
3	7½	G.E.	RF	600/1800
1	7½	El. Dy.		550/1650
1	7½	Watson		525/1150
2	7½	G.E.	RF	450/1800
1	7½	West.	SK	450/1600
1	7½	Al. Ch.		350/1050

110 V. D.C. Motors

Qu.	HP	Make	Type	Speed
1	90	G.E.	DLC65	900
1	30	G.E.	CD	1150
1*	15	EK		1200
1	15	El. Dy.		615/1220
1	10	El. Dy	3S	1100
1	10	West.	SK	850
1	10	El. Dy.	7½S	425/1275
1	10	Diehl		550
1	7½	Cr. Wh.		900
1	7½	West.	SK	500
1	7½	El. Dy.	5S	450/900
2	7½	El. Dy.	5S	600/1200

D.C. GENERATORS

KW	Make	Volts	Amps	Speed
300	West.	250	1200	900
250	G.E.	125	2200	720
100	West.	250	400	720
100	Al. Ch.	250	400	870
100	G.E.	125	800	1150
50	G.E.	250	200	870
50	G.E.	125	400	1150
45	El. Prd.	6/12	7500/3750	400
40	El. Dy.	250	160	1150
30	Reliance	250	120	1750
30	West.	125	240	1160
30	El Dy.	600	50	1150
30	Har.	60	500	1150
25	West.	125	200	1150
25	El. Mchy. Sny.	125	200	1200
25	G.E.	250	100	1150
20	G.E.	125	160	1150
20	West.	250	80	1150
15	Burke	125	120	900
15	G.E.	250	60	1150
10	Al. Ch.	125	80	1150
10	G.E.	250	40	1150
7½	West.	250	30	1150
7½	G.E.	125	60	1150
5	G.E.	250	20	1150
5	West.	125	40	1150
5	G.E.	600	9	1750

15—100/125 Amp. 7½ Volt D.C. Generator 3 ph. 60 cy 220/440 Volt Motors.

SPECIAL
Paper Mill Drive ELECTRONIC Speed Regulated

300 KW West. SK 250 Volt D.C. Generator 900 RPM. with 350 HP. West. SK 250 V. D.C. Motor, double end shaft, speed 0 to 600 RPM. Complete with Pilot Generator, all control and necessary 4 unit Motor Generator exciters.

COOLANT PUMPS

50—New Ruthman (Gusher) Coolant pumps, with ¼ H.P. 3 ph 60 cy. 220/440 Volt Motors.

400 Cycle Generators

3—1 KVA Holzer Cabot 3 ph. 60 cy. 220/440 V.

THIS IS A PARTIAL LIST ONLY!

NEW YORK CITY'S LARGEST STOCK OF ELECTRICAL MACHINERY

L. J. LAND & COMPANY

ESTABLISHED 1910

146 GRAND ST., NEW YORK 13, N. Y. CAnal 6-6976

Branch Offices:
10th & Exeter Streets, Reading, Penna.

Below BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

ONLY PARTIAL LIST

TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts, 1 PH. 25 cy.
1—100 KVA GE, type H Form KDD 11000/2600 volt, 1 PH, 60 cy.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
3—75 KVA Gen. Elect. K.S. 1 ph. 60 cy. 2300/115/230 volts.

OTHER SIZES VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle, 3 phase, 450 R.P.M. with direct connected exciter.
200 KW, Westh. Unity Power Factor, 3 PH, 60 cyc. 220/440 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field. and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

FREQUENCY CHANGERS

80 KVA, Gen. Elect. type I.T.T. frame 526 P.F. 08—220/440 volts 3 Ph. 60 cy. to 240 volts 120 cycle Motor KT frame 526—3 Ph, 60 cy. 220/440 volts 1800 RPM.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. Motors

H.P.	Make	Type	Speed	Volt
350	Gen. Elec.	Sl. Rg. 3 Brg	375	400
200	Lincoln	S. R.	500	440
100	West.	Syn. Stator and Rotor	300	2200
100	Wagner	Sl. Rg.	750	220/440
70	Gen. Elec.	Syn. Stator and Rotor	167	2200

3 ph. 60 cy. A. C. Motors

H.P.	Make	Type	Speed	Volts
200	West.	Syn.-Dir. Con. Ex.	P. F. 08	900 220/440
200	Gen. Elec.	Syn.	ATI	514 4000/2300
200	Weghse.	Syn.	Dir. Con.Exc.	600 2300
150	Gen. Elec.	Syn. Stator and Rotor	ATI	400 2200
25	Gen. Elec.	Sq. Cg.	I. K. Vert.	720 220

230 Volt D. C. Motors

H.P.	Make	Type	Speed
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	700
60	Sprague	D — Comp. Wound	625
40	Fair. Morse	Ball BRG. Vert. Comp.	1740

125 Volt D. C. Motors

H.P.	Make	Type	Speed
60	Allis Chalmers	FB131-Comp.	1755

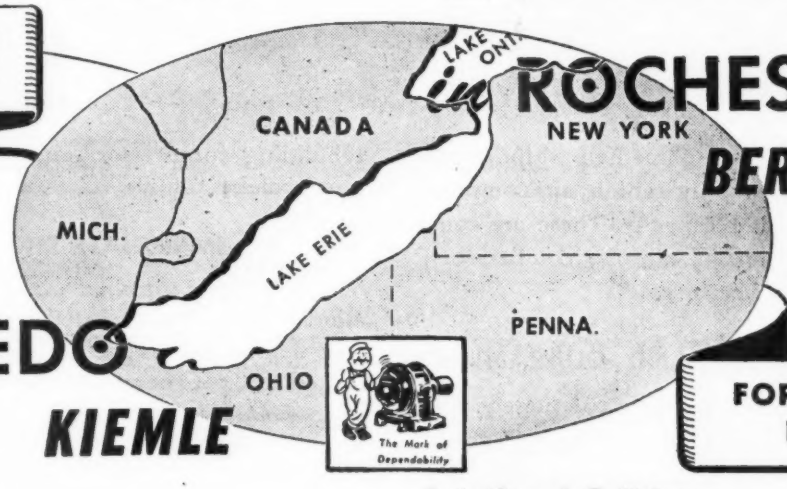
550 Volt D. C. Motors

H.P.	Make	Type	Speed
35	West.	SK 150 Shunt Int.	850

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V. 600 R.P.M.
50 KW—Northern—Comp. 110 V.—700 R.P.M.

OVER 10,000 STOCK ITEMS



THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO 4 OHIO

in TOLEDO

KIEMLE

in ROCHESTER

BERGER

BERGER BROTHERS
ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER 4
NEW YORK

FOR IMMEDIATE DELIVERY

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH, 60 Cy.
3—150 KVA Gen. Elect. Type H 2300/230/460—1 PH, 60 Cy.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 220 Volts—1800 R.P.M.

WEST. D.C.—VARIABLE SPEED MOTORS

10—10 H.P. Type S.K. 230 V. 500/1500 R.P.M. with Automatic Dynamic Braking Starters and Field Rheos.

SYNCHRONOUS—CONVERTER

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
500	Electric Mach.	Syn.	Stator and Rotor	257	440
200	Wghse.	Sl. Rg.	CW	600	220/440
150	Gen. Elec.	S. R.	I. M.	400	440
150	Gen. Elec.	Sq. Cg.	I.K.	600	2300
100	Gen. Elec.	S. C.	K.T.	720	440
100	Lincoln		M	1150	440
100	Gen. Elec.	R	MT.	600	440

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	IM	500	440
100	Allis Ch.	S. R.		750	440
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S. R.	I. M. 17B	160	440
75	Gen. Elec.	Sl. Rg.	I. M.	750	220/440

230 Volt D. C. Motors

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
75	West.	SK 150 Shunt	1200
50	Crocker Wheeler	CM	625

Rebuilt and Sold with a Standard New Guarantee

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

Above KIEMLE OFFERS

SAVE 6 TO 8 MONTHS ON AIR COMPRESSOR DELIVERY!

O'BRIEN has in stock for immediate shipment a large variety of thoroughly rebuilt air compressors up to 2,500 CFM capacity. These are complete units consisting of motors, compressors, aftercoolers and air receivers.

COMPLETELY REBUILT AND GUARANTEED

Each unit is carefully selected, completely dismantled, reconditioned and rebuilt with standard parts in our own shops. Our separate compressor and electrical departments have full facilities for rebuilding compressors and motors to the rigid requirements of the famous O'BRIEN guarantee.

IMMEDIATE SHIPMENT

We've recently supplied a number of war plants almost overnight to help meet accelerated military demands—saving them 6 to 8 months required to get new compressors. If you need *dependable* air compressing equipment in a hurry your best bet is O'BRIEN, the single time- and money-saving source. Wire or phone today for prices and delivery on your specific needs.

NEW—USED—GUARANTEED REBUILT MACHINERY CARRIED IN STOCK FOR PROMPT SHIPMENT

POWER PLANT EQUIPMENT: Turbo Generators • Engine Generators • Diesel Engines Boilers • Blowers • Motor Generator Sets • Electric Motors • Air Compressors • Pumps Heaters • Complete Power Plants • **METAL-WORKING MACHINERY:** Machine Tools of All Kinds • Pipe Machines • Punches • Shears • Welders • Presses and Forging Equipment.

REPRESENTATIVES IN PRINCIPAL CITIES OF THE WORLD

Everything From a Pulley to a Powerhouse

THE O'BRIEN MACHINERY CO.

Bell Telephone: MARKET 4180

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

Cable Address: OBRIEN PHILA

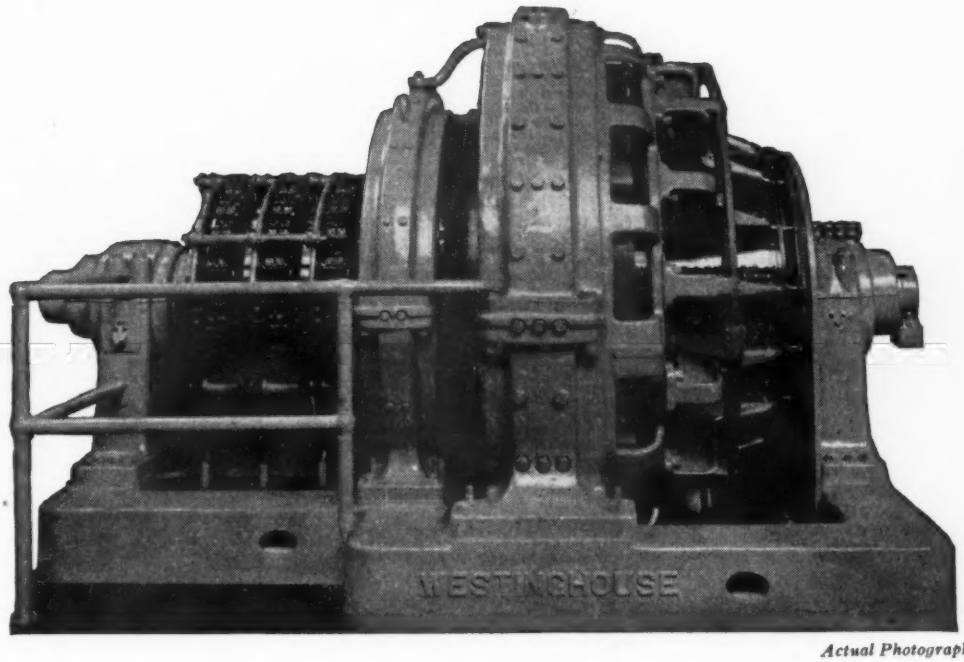
113 NORTH THIRD STREET • PHILADELPHIA 6, PA., U. S. A.

AFFILIATED WITH

SOC EXPANSÃO INDUSTRIAL SUL AMERICANA LTDA

RUA CANDELARIA, 9 RIO DE JANEIRO — BRASIL

ELECTRICAL POWER MACHINERY



Actual Photograph

2250 KW WESTINGHOUSE ROTARY CONVERTER

2250 KW (2) Westinghouse self-starting synchronous rotary converters, 125-250 volts, 3-wire, or 235-300 volts 2-wire, 9000 amps. direct current; 6 phase 60 cycle alternating current, 450 RPM, equipped with 3075 KVA Westinghouse transformers, 3 phase 60 cycle 13200 volts primary

STEAM TURBINE GENERATORS

3 phase, 60 cycle

15630 KVA General Electric condensing turbine generator unit, 6600 volts, 200 lbs. steam pressure, with surface condenser

7500 KVA General Electric condensing turbine generator unit, 2300/4000 volts, 200 lbs. steam pressure, with surface condenser

937 KVA General Electric condensing turbine generator unit, 2300 volts, 150 lbs. steam pressure, with surface condenser

625 KVA General Electric condensing turbine generator unit, 2300 volts, 175 lbs. steam pressure, with surface condenser

312 KVA Crocker Wheeler-Moore non-condensing bleeder type generator unit, 240 volts, 425 lbs. steam pressure, 125 lbs. bleeder pressure, 18 lbs. back pressure

STEAM ENGINE GENERATORS

3 phase, 60 cycle

750 KVA General Electric generator, 2300 volts, direct connected to Skinner uniflow engine, 150 lbs. steam pressure, 5 lbs. back pressure

675 KVA General Electric generator, 480 volts, direct connected to Ames uniflow engine, 150 lbs. steam pressure, 5 lbs. back pressure.

450 KVA General Electric generator, 240 volts, direct connected to Skinner uniflow engine, 150 lbs. steam pressure, 5 lbs. back pressure

312 KVA General Electric generator, 480 volts, direct connected to Skinner uniflow engine, 125 lbs. steam pressure, 5 lbs. back pressure

156 KVA General Electric generator, 2300 volts, direct connected to Skinner uniflow engine, 150 lbs. steam pressure, 5 lbs. back pressure

DIESEL ENGINE GENERATORS

3 phase, 60 cycle

500 KVA Fairbanks Morse generator, 2400 volts, direct connected to Fairbanks Morse Diesel engine, 257 RPM

312 KVA Fairbanks Morse generator, 2400 volts, direct connected to Fairbanks Morse Diesel engine, 300 RPM

291 KVA Fairbanks Morse generator, 2400 volts, direct connected to Fairbanks Morse Diesel engine, 300 RPM, mounted complete on railroad flatcar

219 KVA Fairbanks Morse generator, 2400 volts, direct connected to Fairbanks Morse Diesel engine, 300 RPM

185 KVA Fairbanks Morse generator, 2400 volts, direct connected to Fairbanks Morse Diesel engine, 300 RPM

94 KVA Fairbanks Morse generator, 240 volts, direct connected to Fairbanks Morse Diesel engine, 360 RPM

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.
1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA Westinghouse Cond.
1— 3125 KVA General Electric Extrac.
1— 2500 KVA General Electric Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

D. C. TURBO UNITS
1—1500 KW General Electric 250 V.
2—1000 KW General Electric 250 V.
1— 125 KW General Electric 125 V.
1— 75 KW General Electric 125 V.
1— 25 KW Westinghouse 125 V.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 375 KVA Skinner Uniflow
1— 375 KVA Harrisburg Uniflow
1— 350 KVA Ames Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS
1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire.

OIL & GAS ENGINE UNITS
1—625 HP Worthington, 240 V. 60 cy. gen.
1—520 HP Busch Sulzer, 2400 V. 60 cy. gen.
1—450 HP M.A.N., 2300 V. 60 cy. gen.
1—440 HP Nordberg, 250 V. DC gen.
1—375 HP Worthington, 240 V. 60 cy. gen.
1—300 HP McInt. & Sey., 480 V. 60 cy. gen.
1—283 HP Coop.-Bess., 230 V. 60 cy. gen.
1—175 HP Sterling (gas), 480 V. 60 cy. gen.
2—125 HP Winton, 240 V. 60 cy. gen.

WATER TUBE BOILERS
1—880 HP B. & W. 250-lb., Stoker
1—612 HP Stirling 200-lb.
4—600 HP B. & W. 225-lb., Stokers
2—560 HP Erie City 460-lb.
1—484 HP Springfield 200-lb., Oil Fired
1—481 HP Springfield 225-lb., Pulverizer
2—407 HP Wickes 160-lb., Stokers
2—405 HP Erie City 160 lb., Stokers
2—312 HP Stirling 160-lb., Stokers
2—300 HP Heine 200-lb.
2—300 HP B. & W. 160 lb.
2—220 HP B. & W. 200-lb., Oil Fired

SYNCHRONOUS MOTORS
2—1250 HP G.E. 25 cy. 2200 V. 750 RPM
2—1125 HP G.E. 60 cy. 480 V. 720 RPM
1— 200 HP Ideal 60 cy. 4000 V. 514 RPM
1— 175 HP West. 60 cy. 4000 V. 514 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 125 HP G.E. 60 cy. 220 V. 720 RPM
1— 100 HP G.E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.
4—3500 HP G.E. slip ring 2300 V. 120 RPM
1—2500 HP G.E. slip ring 6600 V. 253 RPM
1—1500 HP G.E. slip ring 6600 V. 253 RPM
1—1000 HP G.E. sq. cage 2300 V. 509 RPM
1—1000 HP West. slip ring 2200 V. 360 RPM
1— 500 HP G.E. slip ring 440 V. 450 RPM
2— 400 HP G.E. slip ring 3800 V. 1800 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
2— 250 HP West. slip ring 2300 V. 450 RPM
1— 150 HP G.E. slip ring 440 V. 450 RPM
1— 100 HP G.E. sq. cage 2200 V. 900 RPM
1— 75 HP G.E. sq. cage 440 V. 514 RPM

MOTOR GEN. SETS—60 Cy.
1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 500 KW Elec. Machy. 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 200 KW Westinghouse 250 V. DC
1— 150 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC

ROTARIES—60 Cy
2—2600 KW General Electric 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
2— 500 KW General Electric 600 V.

FREQUENCY CHANGERS
2—12500 KW G.E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G.E. 25/60 cy. 300 RPM
2— 1250 KVA G.E. 25/62½ cy. 750 RPM
1— 1250 KVA G.E. 25/60 cy. 300 RPM
1— 750 KVA G.E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.
2—10000 KVA West 115,000-6900 V. 3 ph.
4— 500 KVA West. 110,000-2300 V.
3— 4000 KVA West. 63.5/110-19/33 KV
4— 2500 KVA G.E. 63.5/110-1933 KV
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000-33000 V.
3— 600 KVA West. 66000-2300 V.
3— 333 KVA G.E. 66000-480 V.
3— 100 KVA G.E. 66000-6900/11000 V.
3— 1667 KVA G.E. 44000-2300/4000 YV.
4— 1667 KVA Pitts. 33000-2400 V.
3— 833 KVA Al. Ch. 34460-4800/2400 V.
3— 200 KVA G.E. 33000-2300/4000 Y V.
3— 150 KVA G.E. 22000-2300 V.
3— 75 KVA G.E. 33000-13200/11000 V.
14— 75 KVA G.E. 33000-2400 V. New
40— 50 KVA G.E. 33000-2400 V. New
50— 25 KVA G.E. 33000-2400 V. New
1—15000 KVA Al.-Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 667 KVA Packard 23000-440 V.
4— 400 KVA Pitts. 22000/11000-2200 V.
3— 200 KVA G.E. 22000/230/460 V.
1—10000 KVA West. 13200-4560 V. 3 ph.
1— 3000 KVA Kuhlman 13800-480 V. 3 ph.
3— 1667 KVA Pitts. 13200-2300 V.
3— 200 KVA G.E. 13200-480 V. Pyranol
7— 667 KVA Moloney 11000-2300 V.
3— 100 KVA G.E. 6900-230/460 V.
3— 75 KVA G.E. 6900-230/460 V.
6— 25 KVA West. 6900-230/460 V.
3— 833 KVA Penn. 4800-240/120 V.
3— 150 KVA G.E. 2400-120/240 V.

OIL CIRCUIT BREAKERS
1— 400 A. 73 KV G.E. FKO36 Outdoor
1— 400 A. 73 KV G.E. FHKO36 Outdoor
6— 400 A. 37 KV G.E. FHKO136 Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
1— 400 A. 25 KV G.E. FKO136 Outdoor
2— 600 A. 15 KV G.E. FKO37 Outdoor
1— 600 A. 15 KV West. O-221 Outdoor
2— 400 A. 15 KV G.E. FHKO136 Outdoor
6—1200 A. 4.5 KV Condit D-12 Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS
1—6000 KW. G.E. 2300/4000 V.
1—4000 KW. 2300 V. Cond.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1—750 KW. 2300 V. Cond.
1—750 KW. 600 V. Cond.
1—500 KW. 125 V. D.C.
1—375 KW. 440 V. Cond.
1—200 KW. 2300 V. Cond.
1—120 KW. 440 V. Non. C.
1—75 KW. 125 V. Non. C.

ENGINE GENERATORS
1—168 KW. 550 V.
1—100 KW. 250 V. D.C.
1—600 KW. 2300 V.
1—125 KW. Uniflow 600 V.

TURBINES ONLY
1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

BOILERS
1—500 H.P. 200# Oil
2—175 H.P. 200# Oil
2—480 H.P. 225#
1—305 H.P. 185# Stoker
1—200 H.P. 450# Oil
1—150 H.P. 150# H.R.T.

CONDENSERS
1—6000 Sq. Ft. Surface
2—2212 Sq. Ft. Surface
1—1485 Sq. Ft. Surface

AIR COMPRESSORS
1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam Driven
1—860 C.F. 50# Diesel
1—1247 C.F. 55# Motor
1—1214 C.F. 100# Motor Driven
1—600 C.F. 350# Steam Driven
1—386 C.F. 100# Steam Driven

PUMPS
1—3000 GPM 65' Hd Motor
1—1000 GPM Fire Pump Steam
1—750 GPM Fire Pump Steam

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

TURBO GENERATORS
1—937KVA Gen. Elec. with Wheeler condensor
1—500KW Allis Chalmers Moore non-cond.
1—500KW Gen. Elec. non-cond.
1—300KW Gen. Elec. cond.

ROTARY CONVERTERS
1—1500KW 250V Westgh complete
2—1000KW 250V Westgh complete

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generator, Engine Generators, Motor Generators, transformers, Circuit Breakers, etc. Please send us your inquiries.

What have you for sale?

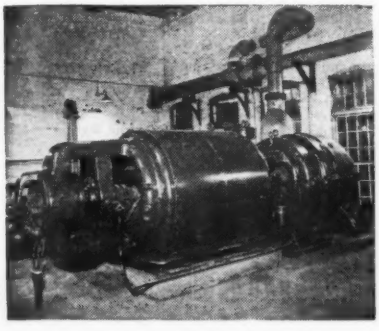
KEYSTONE
Power Plant Equipment Company
8403 Hegerman St., Phila. 36, Penna.

Extraordinary Liquidation

6 COMPLETE POWER PLANTS

Operated by the Georgia Power Company as recently as Dec., 1944

We are listing herewith excellent high-pressure power equipment which has just been released for sale. All this equipment has been maintained in excellent condition and is ready for immediate operation complete with all accessories. Included are all switchboards, motors, panels, transformers, motor-generator sets, exciters, automatic circuit breakers, compensators, rheostats, oil-switches, control-apparatus, pumps, blowers, heaters, piping and all auxiliary equipment. This machinery will move quickly and we urge that you arrange for immediate inspection at the premises.



GENERAL ELECTRIC 2,000 Kilowatt Turbo Generator. Actual Photo As of January 1945.

ATHENS, GA.

1—500 KW Westinghouse Turbo-Generator, 150# Steam Pressure, 2300 Volts, 3 Phase, 60 Cycle, 3600 R.P.M., with Westinghouse-LeBlanc Jet Condenser.
2—370 HP Sterling Water Tube Boilers.
2—390 HP Sterling Water Tube Boilers.
1—600 HP Babcock & Wilcox Water Tube Boiler.
1—300 KW General Electric Rotary Converter, Type HC, 8-300-900, Form P, 60 Cycles, Continuous Current, 600 Volt, 500 Amps., complete with Panel and Transformers.
1—Pawling & Harnischfeger Overhead Trolley Crane.
1—160' Steel Stack (approximate).

AMERICUS, GA.

2—375 KW Allis-Chalmers Turbo-Generators, 160# Pressure, 3600 R.P.M., 2300 Volts, 94.4 Amps., 3 Phase, 60 Cycle, with Wheeler Surface Condensers.
1—575 KW Allis-Chalmers Turbo-Generator, 160# Pressure, 2300 Volts, 157 Amps., 3 Phase, 60 Cycle, with Wheeler Surface Condenser.
1—Maris Bros. Overhead Crane.
2—200 HP Casey Hedges Water Tube Boilers, F-27-38 Foster Superheaters.
1—300 HP Heine Water Tube Boiler.
1—81' Steel Stack.

AUGUSTA, GA.

1—2750 KW General Electric Turbo-Generator, Steam Pressure, 150#, A.C. Generator, Type AQB, Class 4—Form HT, Speed 1800 R.P.M., 2300 Volts, 598 Amps., W. M. Kellogg Co. Twin Bulkley Injector Condenser.
3—400 HP Casey Hedges W T Boilers.
1—500 HP Casey Hedges Water Tube Boiler. Foster Superheater. These Boilers are Oil-Fired, system complete, Automatic Draft Control equipment, etc.

LANGSDALE, ALA.

1—2000 KW General Electric Turbo-Generator, 180# Pressure, 3600 R.P.M. Generator, Type ATB, 600 Volt A.C., 2403 Amps., with Westinghouse-LeBlanc Jet Condenser.
1—750 KW General Electric Turbo-Generator, 150# Pressure, Type ATB, Form HT. 600 Volts, 3600 R.P.M., with Westinghouse-LeBlanc Jet Condenser.
3—308 HP Heine Water Tube Boilers.
1—518 HP Heine Water Tube Boiler.
1—Overhead Trolley Crane—Maris Bros., 20 Ton.

For Further Details

TELEPHONE, WIRE OR WRITE US AT THIS OFFICE OR THAT OF OUR SOUTHERN ASSOCIATES

ATLANTA STEEL AND SUPPLY COMPANY

349 Decatur Street

Atlanta 3, Georgia

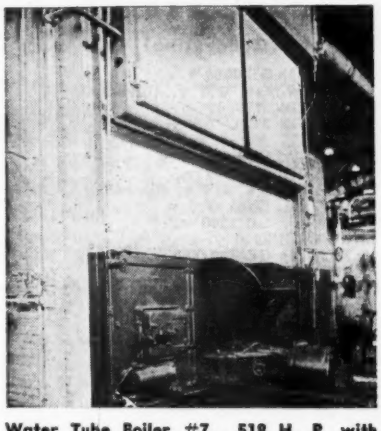
Telephone Walnut 9412 Main 4947

GRIFFIN, GA.

1—2000 KW General Electric Turbo-Generator, 2500 KVA, 6600 Volts, 219 Amps., 3600 R.P.M., Type ATB, Form HT, direct-connected Exciter with Elliott Jet Type Condenser.
1—1250 KW General Electric Turbo-Generator, Type ATB, Form HT, 3600 R.P.M., direct-connected Exciter, Wheeler Jet Condenser.
2—512 HP Babcock & Wilcox Water Tube, Sectional Type, 200# Pressure Boilers.

ALBANY, GA.

1—1000 KW General Electric Turbo-Generator, 150# Pressure, Type ATB-2, Form T, 2300 Volts, 314 Amps., 3600 R.P.M., with Worthington Barometric Condenser.
1—600 KW Westinghouse Turbo-Generator, 2300 Volts, 187 Amps., 3 Phase, 60 Cycle, 3600 R.P.M., with Worthington Barometric Condenser.
1—500 HP Sterling Water Tube Boiler.
1—250 HP Walsh & Weidner HRT Boiler.
2—250 HP R. D. Cole HRT Boilers.



Water Tube Boiler #7. 518 H. P. with Westinghouse Single Retort Underfed Stoker—200 lbs. pressure. Actual photo as of January 1945. Boiler—Heine

REPUBLIC TEXTILE EQUIPMENT COMPANY

REFINANCING - APPRAISAL - PURCHASE - SALE - LIQUIDATION OF MILL PROPERTIES

PURCHASE AND SALE OF USED MACHINERY

40 Worth Street, New York 13, N. Y. **Cortland 7-1591**

ELECTRIC CONTROL EQUIPMENT

AUTOMATIC AND MANUAL

PROMPT SHIPMENT

SLIP RING MOTOR CONTROL

1—3 HP, Cutler Hammer, enclosed manual, machine duty, regulator, 3 phase, 60 cycle.

1—3 HP, General Electric, manual enclosed, face plate starter, Cat. No. 2091301G2.

1—3 HP, Schaeffer, Inc. manual, face plate, regulator, 220 v., sec. 13 amperes, 72.5 v.

1—5 HP, Cutler Hammer, open type, automatic pri. manual preset secondary control, reversing, 3 phase, 60 cycle, 220 v., 114 v. Sec. 20 amperes, sec.

1—7½ HP, General Electric, manual, open type, face plate type CR1264, machine duty, with interlocks, 3 phase, 60 cycle, Cat. No. 2218171-G5.

1—7½ HP, General Electric, 3 phase, 60 cycle, 220 v. type CR6133A3, No. DL220-2003G371, open type, prtg. press duty, automatic pri. manual preset sec.

1—7½ HP, General Electric, open type, prtg. press control, 3 phase, 60 cycle, 220 v., type CR6133-A1, No. DL2097516-G15, automatic pri. manual preset sec.

1—10 HP, Cutler Hammer, open type, automatic control, manual preset, speed control, prtg. press service, 3 phase, 60 cycle, 220 v.

1—10 HP, Cutler Hammer, open type, automatic control, 3 phase, 60 cycle, 220 v., 27 amperes, sec. 75 v. sec. 59 amperes, definite time accel.

1—10 HP, General Electric, open type, 60 cycle, 220 v., prtg. press control, CR6131-A1, automatic pri. manual preset sec.

1—15 HP, Cutler Hammer, automatic starter, 3 phase, 60 cycle, 440 v., sec. v. 91, sec. amperes 71, enclosed.

1—15 HP, Westinghouse, enclosed, automatic control, starting duty, 3 phase, 60 cycle, 220 v., order non-reversing.

1—15 HP, Cutler Hammer, manual open type, face plate starter, 3 phase, 60 cycle, 220 v., sec. volts 320.

1—15 HP, General Electric, manual, open type, face plate starter, 220 v., 60 cycle, type CR1023.

1—15 HP, General Electric, automatic 3 phase, 60 cycle, 220 v., CR7012B1, stg. duty automatic—Sec. amperes 47, open type.

1—25 HP, General Electric, A.C., 3 phase, 60 cycle, 2200 v., type CR7012-D1-, stg. duty—Pri. and sec. control, open type.

1—25 HP, General Electric, enclosed, automatic slipring starter, non-reversing, 3 phase, 60 cycle, 220 v., sec. amperes 86, type CR7022, A1.

1—25 HP, General Electric, open-type manual face plate starter, 1.14 OHMS, 130 amperes, sec. CR1023.

1—30 HP, Cutler Hammer, automatic starter, series coil Accel., 3 phase, 60 cycle, 220 v., sec. v. 340, sec. amperes 40, open type, non-reversing.

1—40 HP, General Electric, open manual face plate starter, 400 v., CR-1023.

1—50 HP, Allis Chalmers, open manual, machine duty, regulator, 132 v., sec. 180 amperes, 3 phase, 60 cycle.

6—50 HP, Westinghouse, manual, slipring control units, self contained, 80 amperes sec., style 74864B, stg. duty.

6—50 HP, Westinghouse, same as above, style No. 218388, stg. duty.

1—50 HP, Cutler Hammer, enclosed panel, manual, 220 v., 125 amperes pri. 204 v., 103 v. sec., 3 phase, 60 cycles, starting duty, No. 810992A, automatic primary, manual sec., semi-automatic slipring control.

1—75 HP, Cutler Hammer, totally enclosed, automatic starting control, 3 phase, 60 cycle, 220 v., sec. volts 219, sec. amperes 160, primary and sec. control.

1—150 HP, Allis Chalmers, slipring control, 3 phase, 215 amperes, 334 v., type ANY manual, open type, reg. duty.

1—150 HP, General Electric, auto starting panel, type CR7442-A3, DL3651440-G3, 60 cycle, 3 phase, 2200 v., automatic secondary control panel for mine hoist service, 166 amperes secondary.

1—200 HP, Cutler Hammer, A.C. starting panel manual control, 3 phase, 60 cycle, 440 v., 255 amperes. Manual slipring control.

1—200 HP, General Electric, automatic control; General Electric air compressor service, 3 phase, 60 cycle, 2200 v. control, 51.5 pri. amperes, type CR7012-Y1, secondary control only—open panel.

1—200 HP, Cutler Hammer, manual open type, 3 phase, 60 cycle, 220 v., sec. volts 480, sec. amperes 200, secondary control only.

1—375 HP, General Electric, manual primary and sec. control panel for slipring motor with 1 General Electric non-reversing drum control; 1—3PST oil circuit breaker, G.E. 100 amperes, 2500 v., type FK3, with operating lever and 2 coil O.L., 3 phase, 60 cycle, 2200 v. slipring motor.

1—500 HP, General Electric, automatic, type MTC, 209A, 9 sec. starting panel, DL128712, diagram 35069, 2200 v., 3 phase, 60 cycle, open type.

1—500 HP, General Electric, automatic secondary panel, 9 sec., type CR2124, No. DL1761511, 3 phase, 60 cycle, 2200 v., slipring mine hoist service.

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 **CHICAGO 8, ILL.**

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

(Condensing)

5000 KVA (2) GE 2300 v.
3750 KVA Wghse. 600 v. (bleeder)
3750 KVA GE 2300 v.
3150 KVA GE 2300/4000 v.
3125 KVA GE 480 v. (bleeder)
2500 KVA Al. Chal. 2300 v.
2500 KVA Wghse. 600 v.
1560 KVA Wghse. 480 v. (bleeder)
1553 KVA Al. Chal. 480 v.
937 KVA (2) GE 2300 v.
750 KVA GE 2300 v.
500 KVA (3) GE 240/480 v.
375 KVA GE 2300 v.
312 KVA Elliott. 480/240 v.

A C TURBINE UNITS

(non. cond.)

375 KVA GE 2300 v.
312 KVA CW-Moore 240 v., 400#
110 KVA Al. Chal.-Kerr, 240 v.

BOILERS

880 HP B & W 200#
612 HP Sterling 250#
600 HP (6) B & W 200#
522 HP Kidwell, 207#
396 HP B & W 160#
328 HP (4) Sterling, 160#
305 HP Kidwell, 190#
300 HP (2) Union, 175#
300 HP B & W 200#
275 HP (2) B & W 160#
250 HP (4) Wickes, 160#
231 HP B & W 250#
180 HP B & W 3 drum, 160#
150 HP HRT 152#
150 HP Erie Economic, 125#

PUMPS (motor driven)

8000 GPM Al. Chal. 132' Head
7000 GPM Morris 80' Head
7000 GPM Morris (dredge pump)
3250 GPM Morris 425' Head
3000 GPM Al. Chal. 65' Head
1000 GPM Al. Chal. 246' Head
1000 GPM Morris 255' Head
800 GPM Al. Chal. 325' Head
725 GPM Wheeler, 30' Head
700 GPM DeLaval 85' Head
700 GPM Cameron 566' Head
470 GPM Dean-Hill 693' Head
420 GPM (2) Worthing. 630' Head
340 GPM Worthing. 208' Head
300 GPM Ingersol 580' head — TURBINE driven

STEAM ENGINE SETS (AC)

312 KVA Wghse.—Skinner Unif.
180 KVA G.E.—Chuse 4 v.
250 KVA Wghse.—Nordberg Unif.

STEAM ENGINE SETS (dc)

300 KW G.E. 3 wire—Skinner Unif.
250 KW CW 250 v.—Skinner Unif.
150 KW GE 250 v.—Erie Ball, 4 v.

DIESEL ENGINE SETS (ac)

300 KVA Fairbanks Morse "VA"
219 KVA Burke—Buckeye

TRANSFORMERS

833 KVA (3) Wghse. 13200/2300
667 KVA (3) Al. Chal. 6930/2300-4000
667 KVA (3) GE 22000/460
500 KVA (4) Wghse. 11000/2300
500 KVA (2) GE 11950/6900-230/460
500 KVA (2) GE 6600-2300
400 KVA (3) GE 2300-440
333 KVA (3) GE 23000/2300
250 KVA (2) Pittsburg 13200-460
250 KVA (9) Wghse. 6900-440/220
250 KVA (2) GE 6600-2300
250 KVA (3) Al. Chal. 4800-240/120
200 KVA (3) GE 13200/6600-575
200 KVA (3) GE 2400-240/120
150 KVA (3) GE 2300-240/120
150 KVA (3) GE 22000/33000-230/460
125 KVA (3) Wghse. 6600/2200-220/440
125 KVA (3) Bellis 440-17 to 24 v.
100 KVA (6) GE 6600-240/120
100 KVA (3) Wghse. 13200-2300

TRANSFORMERS (3 ph.)

850 KVA GE 13800-2300
750 KVA Wagner, 6600-2200
300 KVA GE 2300-460/230

WAGNER

"Certified Rebuilt" ELECTRICAL APPARATUS

M-G SETS

150 KW Allis-Chalmers gen. DC 250 volts, coupled to 250 H.P. Gen. Elec. Synch. motor, 3-60-220/440 volts.
100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage I-K motor 3-60-2200/4000 V.—1200 RPM.
50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440 V. 1800 RPM.
35 KW Gen. Elec. DLC gen. DC 250 V. to 50 HP AC motor 3-60-220/440 V.
30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v. 1160 RPM, late style 3 brg. unit.
10 KW Gen. Elec. CD95 gen. DC 65 V. 300 amp. to 30 HP G.E. KT motor 3-60-220/440 V.

Many others available—special units built to order

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Northw'n	interpole	230	1700
100	Reliance	1050T	230	500/1200
100	Sprague cradle dynamometer		250	1650/2500
60	G.E. Sprague (2)	LC	250	700/2000
50	Whse.	SA	230	450/1350
40	Gen. Elec.	DLC	230	750
40	Roth	8	115	850
40	Whse. (2)	8K158	230	575
30	Sprague	LC	230	600/1200
30	Sprague	dynamom	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Gen. Elec.	DLC	230	500/1500
20	Fair Morse	TR	230	325/700
20	Whse.	SK	230	850
20	Whse.	SK111	230	250/1000
15	Whse.	SK80	230	1150
15	Gen. Elec.	LC	230	550/1100
15	Gen. Elec.	CD83	230	1150
15	Whse. (6)	SK90	230	850
15	Gen. Elec.	CD95	115	575/17

QUICK SHIPMENT FROM STOCK

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	150	Whse. New b. b.	CS771.18	1800
1	150	Gen. Elec. 2200 v.	I-K	900
1	100	Gen. Elec.	I-K	720
1	75	Cr. Wheeler	SC	1800
1	75	Whse.	CCL	720
1	75	Gen. Elec.	I-K	600
1	60	Century	AS40	1800
1	50	Allis Ch.	AN	900
1	50	Gen. Elec. 2200 v.	KT327	1800
1	40	Howell 440 v.	SCBB	3600
1	40	Allis Ch.	AN	720
1	40	Gen. Elec.	I-K	1200
1	40	Gen. Elec.	KT332	1200
2	30	Allis Ch.	AN	1200
1	30	Allis Ch.	AN	600
6	30	Allis Ch.	AN	900
2	30	Allis Ch.	AN	720
2	30	Gen. Elec.	KT326	1200
1	30	Lincoln	C11	1800
1	25	F. Morse b. b.	H12A	1200
2	25	Allis. Ch.	AN	1200
2	25	Gen. Elec.	KT302	1800
1	25	Gen. Elec.	KT322	1200
2	25	Allis Ch.	AN	900
1	25	Allis Ch.	AN	600
1	25	Whse. New	CS405	1200
6	20	Whse. New	CS364	1800
1	20	Wagner	17TBW	1800
2	20	Gen. Elec.	I-K	1200
3	20	Whse.	CS	900

25 CYCLE MOTORS

H.P.	Mfr.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
300	Whse.	CW sl. rg.	500
150	Whse.	HD sl. rg.	500
150	Gen. Elec. 2200 v.	MT359 sl. rg.	1500
100	Whse.	CCL sq. cg.	500
100	Gen. Elec.	I-K	750
50	Allis Ch.	ANY sl. rg.	1500
25	Gen. Elec.	I-K	1500

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
350	Gen. Elec. 3 brg.	ATB	220/440	600
300	Whse.	ped.	220/440	900
250	G. E. 1-brg.	ATI	220/440	600
190	Gen. Elec.	ATB	220/440	600
150	Gen. Elec. 3 brg.	TRB	220/440	450
50	Burke		220/440	1200

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	350	Allis Ch.	ANY	514
1	350	F- Morse 2200 v-	HV	600
1	300	Burke	EMV	225
1	200	Gen. Elec. 2200 v.	I-M	600
1	175	Lincoln	IXV	600
1	150	Gen. Elec.	I-M	600
2	150	Allis Ch. 3 brg.	ANY	514
1	100	G.E. 2200 v.	I-E13A	1800
1	100	Gen. Elec. 3 brg.	I-M	450
1	100	Whse. 2200 v.	CW	1200
1	75	G.E. 2200 v.	I-E13	1800
1	75	Gen. Elec.	MT558	600
1	75	Gen. Elec. 2200 v.	I-M	900
1	65	P. & H. b. b. Int.	CA16	900
1	60	Whse. 2200 v.	CW657	1800
3	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. b. b. 2200 v.	ARY	900
1	50	Gen. Elec.	MT342	900
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec. 2 ph	MQ536	900
1	40	Northw'n	HW35A	1200
2	40	Gen. Elec.	MT532	1200
1	40	Fair Morse b. b.	HV	900
1	40	Whse.	CW	900
1	40	Watson b. b.	KHV	1200
2	40	Allis Ch.	ANY	450
1	35	Fair Morse b. b.	HV	1800
2	30	Northwestern b. b.	HW404	1800
2	30	Allis Ch.	ANY	900
2	30	Whse. enclosed	MA	600

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
250	Northern		250	360
150	Allis Ch.		250	600
40	Whse.	SK	250	720
35	Gen. Elec.	DLC	250	900
30	Lincoln b. b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	LC	250	900
19	Gen. Elec. 300 amp.	CD	65	1200
16	Cr. Wheeler	CCD	125	415

ALSO IN STOCK . . . OIL SWITCHES BLOWERS & FANS . . . SPEED REDUCERS . . . 500 NEW MOTORS

60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
500	Gen. Elec. 3 brg.	ATB	2300	450
300	Gen. Elec. 3 brg.	ATB	240/480	600
300	Whse.	ped.	240/480	900
300	Elec. Machy. 3 brg.		240/480	720
250	Gen. Elec. 1 brg.	ATB	240/480	600
200	Gen. Elec.	TRB	240/480	720
150	Allis Ch.		2300	900
125	Whse.	ped.	2300	600
100	Cr. Wheeler		240/480	600

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

GOOD VALUES—Always

Fairbanks Morse Diesels, 225, 240, 280, 360, 375, 420 HP. Also generators.
McIntosh Seymour complete diesel generator sets 1000 & 300 HP, 2 or 3 phase 60 cycle, 240, 440, 600 or 2300 volt generators.
DeLaVergne 260 HP Diesel Generator.
Busch Sulzer Diesels. 400, 500, 600 HP.
Boilers. 30 HP vertical to 800 HP in water tube types. 100 to 250 lbs. 2—80 HP H.R.T. in steel encased battery. 2—260 HP H.R.T. Now being reconditioned.
Derricks. 10, 20, 50 ton Guy & Stiffleg.
Steel Sheet Piling, Pile Hammers, etc.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

DIESELS

2-300 H.P.
FAIRBANKS 6 CYL.
DIRECT CONNECTED TO
2-240 K.W. 3/60/2300V.

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

THE GLOW ELECTRIC COMPANY

933-943 HARRIET ST. Phone MA. 3024 CINCINNATI 3, OHIO

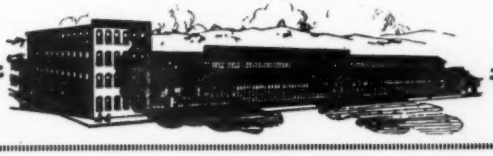
Solicits your inquiries for

AC & DC MOTORS
—GENERATORS
SYNCHRONOUS MOTORS
MOTOR-GENERATOR SETS
STEAM ENGINE-GEN. SETS
SLIP RING MOTORS
CONTROL EQUIPMENT
PUMPS
ELECTRIC HOISTS

IN EXCESS OF 12,000 ITEMS ARE AVAILABLE, TOO NUMEROUS TO LIST.

WE BUY SURPLUS ELECTRIC EQUIPMENT

IN BUSINESS SINCE 1905



MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 phase, 25 cycle, 220/440 Volts

HP	Make	RPM	Type	Frame
(3) 2	Westg.	500	CS284	T.E.F.C.B.B.
2	Gen. Elec.	750	K	254
2	Allis Chal.	750	AR	
2	Westg.	1500	CS	231
2	Gen. Elec.	1500	KT	934
3	Fair. Morse	750	R	
3	Rob. & Myers	750	K	204
3	Reliance	715	ball bear.	
3	Gen. Elec.	750	KT	750
3	Master	1500	PA	ball bear.
3	Master	1500	PA	ball bear.
(12) 5	Westg.	750	MS	
5	Northw'n	1430	H3A	
(3) 5	Valley Elec.	1500	718	vertical
7½	Westg.	500	CS	
7½	Gen. Elec.	750	KT	954
7½	Allis Chal.	720		
(3) 7½	Westg.	750	MS	
(5) 7½	Westg.	750	CS	
7½	Gen. Elec.	1500	KT	181
7½	Wagner	1450		
10	Westg.	500	CS	
10	Gen. Elec.	500	I	form K
10	Wagner	500	BP	
(2) 10	Westg.	500	MS	
(2) 10	Gen. Elec.	750	KT	512
10	Cr. Wh.	720		
(7) 10	Wagner	710	19TBM	
15	Gen. Elec.	750	I	form K
(3) 15	Westg.	710	MS	
(2) 15	Allis Chal.	725		
15	Westg.	1500	CCL	
15	Gen. Elec.	1500/423	tot. enc.	back geared

MOTOR GENERATOR SET

1—125 KW Ridgeway 250 V. DC 1200 RPM. direct. connected to 180 HP. Ridgeway Motor 3/60/440 Volts 1200 RPM. DC. Panel and Starting Compensator.

FREQUENCY CHANGER SET

1—1250 RVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

TRANSFORMERS

3—150 KVA. General Electric Type H, Form KS, 2400 Volts Primary 120/240 Volts Secondary.

REBUILT MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Crocker Wheeler		600	131413
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	944593
20	Westinghouse	CS	1200	2160590
20	Star	BB404	1200	10551
20	Westinghouse	MS	1200	1056826
20	Westinghouse	MS	1200	1246745
20	Westinghouse	MS	1200	1056827
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	1930159
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Armor	BB	720	4343
30	Crocker Wheeler		720	17270
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CCL	350	581480
40	Westinghouse	CS	900	1886969
40	General Electric	I-K	1800	73318
40	General Electric	I-K	1800	68511
40	General Electric	I-K	1800	77017
40	General Electric	I-K	1800	73316
40	Westinghouse	MS	1800	1506800
40	Westinghouse	MS	1800	1051548
40	Westinghouse	MS	1800	1056802
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	CCL	400	541841
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	Westinghouse	CS	1800	1949877
50	General Electric	14	1800	181444
50	Reliance		1800	Z20194
50	Allis Chalmers		1800	3K28825
60	Westinghouse	CS	900	4884402
60	Reliance		1200	B11458
60	Westinghouse	CCL	450	518408
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
75	Westinghouse	CCL	514	450185
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CCL	600	416173
100	Westinghouse	CS	900	2207524
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	General Electric	KT562	720	
125	Westinghouse	CCL	720	427284
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	720	122809 (2200 v.)
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	I-K	600	2246834
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845

SLIP RING MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
1	Westinghouse	CW	1200	5348371
1	General Electric	MT122	1200	232163
1	General Electric	MT122	1200	3797628
1	General Electric	MT122	1200	2323624
1½	General Electric	MT140	1200	1416002
1½	General Electric	MT140	1200	811798
15	General Electric	I-M	900	1225064
15	General Electric	MT322	855	3088717
13	K.W. Sachsenwerk	D7-3/8	850	295481
20	Westinghouse	CW644C	575	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	1558408
40	Westinghouse	CW748	690	4406823
40	Westinghouse	CW748	690	4406825
40	Westinghouse	CW748	690	4406821
40	Westinghouse	CW748	690	4406819
40	Westinghouse	CW748	690	4405824
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

MOTORS

230 VOLT DC MOTORS

Constant Speed

Qn.	H.P.	Make	Type	Speed
1	400	Al. Ch.		415
1	125	Gen. Elec.	DLC	550
2	75	West.	S-130	475
2	50	West.	SK-160	565
3	40	Gen. Elec.	DLC	610
1	30	West.	SK-140	600
2	30	Gen. Elec.	RC-31B	1150
1	25	West.	SK	1100
3	25	Gen. Elec.	RC-31	1150
3	15	West.	SK	675
11	15	Gen. Elec.	RC	800
2	15	West.	SK	825
10	15	Gen. Elec.	RC	1150
13	10	Gen. Elec.	RC	850
1	10	Gen. Elec.	RC-9	1150
1	10	Watson	AW9B	1500
2	7½	West.	SK	850
1	7½	Gen. Elec.	RC	850
30	7½	Crocker Wh.	CCM	875
1	7½	Eck.	712	1750
27	5	West.	SK-40	850
1	5	Star BB	SBF-3	3600
1	2	West.	SK	680
1	2	Robbins & Myers		1750

SYNCHRONOUS—SLIP RING

Qn.	H.P.	Make	Type	Speed
1	150	Gen. Elec. (Syn.)	ATI	900
1	150	Al. Ch. (Sl. R.)	3 brg.	600
1	150	F. M. (Sl. R.)		1800
1	75	Gen. Elec. (Syn.)	ATI	900
1	15	Star (Sl. R.)		900

230 VOLT DC MOTORS

Variable Speed

Qn.	H.P.	Make	Type	Speed
1	125	Gen. Elec.	CL	310/900
1	100	West.	SA	250/350
2	40	Gen. Elec.	CL	650/1300
3	30	West.	SK	600/1200
1	16-17½	West.	SK	600/1200
6	15	Gen. Elec.	RF-10	550/1650
1	15	West.	SK	400/1600
1	15	West.	SA-9	300/1200
1	10	Gen. Elec.	RF-10A	600/1800
1	8½	West.	SK	350/1400
1	7½	West.	SK	400/1600
7	3	Roth Bros.		500/1000
20	2	Gen. Elec.	RLC	415/830
1	2	West.	SK-23	700/2100

SQUIRREL CAGE MOTORS

220/440 V. 3 Ph., 60 Cyc.

Qn.	H.P.	Make	Type	Speed
1	400	West.	CS	690
2	150	Al. Ch. (2200 V.)		1185
1	100	Gen. Elec. (2200 V.)	IK	500
1	75	Al. Ch.		900
1	75	Al. Ch.		600
1	50	Al. Ch.		900
1	40	Reliance		860
1	30	Wagner		600
3	30	Wagner		720
1	25	Al. Ch.		900
1	25	F.M. (B. B.)		1800
1	15	Century	SCN-19	1200
1	10	Gen. Elec.	IK	1200
2	7½	Al. Ch.	AN	1150
2	5	Al. Ch.		1800
5	3	Imperial	224	3600

SPECIAL!

800 KW Synchronous Driven Motor Generator Set 3 phase, 60 cycle, 13200 volts AC 230 volts DC, complete unit with panelboard.

Available immediate delivery. Reasonably priced.

BOILERS

4—1010 HP Heine Water Tube Boilers, 250 lbs. pressure, complete with Superheaters, Bethlehem Dahl Oil Burners, all valves, piping and fittings.

2—440 HP New Westinghouse single retort moving grate stokers, complete with hydro feed drives, blowers and all accessories. Will operate at 200% of rating. Never installed.

MOTOR GENERATOR SET

50 KW Westinghouse SK 150L—1200 RPM, 125 volt DC, connected to 75 HP CS-764, 2200 volt, 3 phase, 60 cycle, 1200 RPM motor.

TURBO-GENERATORS

6250 KVA Westinghouse Turbo-Generator Set: Turbine 3600 RPM, 200 lbs. pressure, 125° Superheat, complete with condenser, pump and air washer. Generator: 6250 KVA, 3 phase, 60 cycle, 2300 volt, 3600 RPM, with turbo-exciter and Motor Generator Exciter.

75 HP, Westinghouse Turbine, non-condensing, 200 lbs. pressure, 7200 RPM, connected through reduction gear to 50 KW 125 volt DC Generator, 1200 RPM.

750 KW Ridgway Elliott-Turbo Set, mixed pressure, 1800 RPM, 230 volt DC.

Heat and Power

COMPANY

45 BOND ST. • ALGONQUIN 4-3874 • NEW YORK 12, N. Y.

NON-COND. TURBOS

1—1000 KW Wemco 60/3/2300V/1800 RPM/150# 10# B.P.
1—1000 KW Wemco turbine. 350#, 700° T.T.—gen. new or used avail.
1—1000 KW G.E. 60/3/480V. 150# 100° S.H. 30# B.P.
1—1000 G.E. 150# 15# B.P.
1— 500 KW G.E. 60/3/2300V. 100-125#, 2# B.P. New 1924.
1— 300 KW G.E. 60/3/240V. Bleeder, 4000# per hr. 10# B.P.
1— 500 KW Wemco mult. exp. parallel flow 60/3/440V/3600 RPM 150-200# 10# B.P.
1—750 KW Moore 200# 100° S.H. 10# B.P. 75# ext. with 2—633 HP boilers.

COND. TURBOS

1—6000 KW Wemco 76 CW, 60/3/2300/225# equal new.
1—4000 KW G.E. 60/3/2300V/200# 125° S.H. surf. cond.
1—3000 KW G.E. Curtis 60/3/2300V/150# surf. cond.
1—2000 KW Wemco 60/3/440V/180# surf. cond.

COND. TURBOS (Con't)

1—1250 KW Wemco Bldr. 60/3/480V/150#/120° S. H. 3600 RPM Bldg. 15#G, 15,000# per hr.
1—1250 KVA Allis A.C. 60/3/2300/3600 RPM 150-200#, 100° S.H.
2—1000 KW 150/200# Allis Chalmers Surface Cond. 60/3/2300V/3600 RPM.

ASME BOILERS

1—1250 HP steam generation plant complete. Superheater, Economizer, Steel encased 14 retort stoker, 100,000# Cont.
2—612 HP 200# 125° S.H. Stirling.
4—500 HP Hine 190# 150° S. H.
2—500 HP B&W 200# 100° S.H. Comb. Eng. Type E stoker all auxs.
1—500 HP Edgemoor 175# Comb. Eng. Type E stoker.
2—365 HP Edgemoor 200# 100° S.H. Ram type stoker.
1—313 HP 250# Edgemoor 125° S.H. stoker.
1—200 HP Brownell HRT 125# New 1936; Stoker.
2—125 HP Leffle Scotch Marine 125# Oil Burners.
1—305 HP Kidwell 185#, 125° S.H. Stoker.

50 YEARS OF SERVICE

LET US PLACE YOUR MODERN IDLE EQUIPMENT

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
20	Westg.	220	575	CW
20	Allis Chal.	440	1130	
20	Allis Chal.	440	680	
25	Westg.	220	720	CW
30	Westg.	220	900	CW
30	West.	220	1800	CW
30	West.	220/440	787	CI
50	Westg.	440	1145	HF
50	Chandeya'n	220/440	1800	
50	Allis Chal.	220	490	
75	West.	220/440/2200	580/290	CW
100	West.	220/440	685	CW
150	West.	2200	375	CW
150	West.	2300	490	CW
150	West.	220/440	490	CW
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
1500	Westg.	2200	435	3W

ALTERNATING CURRENT MOTORS
3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
25	West.	220/440/550	1200	CS
25	Lincoln	440	900	
25	West.	220/440	1160	CS
30	West.	220/440	860	CI
30	G.E.	440	1800	KT
30	Triumph	220	525	TR-133
30	Allis Chal.	220/440	1200	
35	West.	220/440	575	CS
40	Howell	220	900	SO
40	G.E.	440	1800	KT-527-4
40	Triumph	440	1760	S8825
40	Lincoln	440	1800	Flev.
40	G.E.	440	900	KT
50	West.	220/440	870	CS
50	West.	220/440	720	CS
50	G.E.	220	1200	
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	West. El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Cr. Wh.	240/480	1200	Syn.
50	Allis Chal.	440	1800	AN
50	G.E.	220/440	1200	HI
50	G.E.	440	1160	KT
50/32	G.E.	440	800/640	
65	West.	220/440	1150	CS
100	Allis Chal.	220	1750	
100	Allis Chal.	220	600	
150	Wagner	440	1800	31V
150	G.E.	2200/220/440	450/243	
175	G.E.	2200	600	I-12
200	Westg.	2200	900	
1500	G.E.	2200/220/440	225	ATI-Syn.
3500/4000	West.	4000/23000	900	Syn.

VARIABLE SPEED MOTORS—
230 VOLT D.C.

H.P.	Make	R.P.M.	Type
1.5	Roth	850/1700	
2	Star	400/600	SB
2	G.E.	400/1600	RLC
2	G.E.	415/830	RLC
2	Reliance	550/2000	
2½	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
3	Jantz-Liest	650/1950	BI-DC
3	Roth (Enclosed)	500/1000	RS
3	G.E.	400/1200	RLC-114
3¼	Westg.	400/1600	SA
3½	Westg.	850/1700	
5	Reliance	600/1800	
6	Roth	500/1000	
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v
7½	Westg.	1125/2905	SK-43
7½	Westg.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
15	Reliance	500/1800	
20	Westg.	750/1500	SK-110L
30	G.E.	450/900	RLC
75	West.	475/950	SK-180
75	West.	400/650	SK-181

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
6	Ilg.	230	380	
10	West.	230	650	MT-00
15	Cr. Wh.	220	270	SM
15	West.	230	800	HD
25	West.	230	600	MT
32	Shaw	230	485	5L2E
68	G.E.	220	475	
80	West.	230	490	76-A
175	G.E.	230	475	MD

TRANSFORMERS—1 ph. 60 cy.

No	KVA	Prl.	Sec.	Make
1	2	6600	110/220	G.E.
3	5	2300	220/440	G.E.
1	5	2200	110/220	West.
84	7½	2200	220/110	G.E.
32	7½	2200	220/110	West.
12	10	2200	220/110	West.
13	10	2200	220/110	G.E.
2	15	400/30000/50000		American
1	25	2200	220/110	G.E.
6	35	220	110	West.
3	50	6600	575/440/220	G.E.
2	50	6600	550/440	Al. Ch.
1	75	2200	220	Burke 3 ph.
3	75	2200	220/440	West.

HOIST

1—3 ton Westghse Hoist with Westghse DC Mtr., 1000 rpm.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS
250 volts

1—5 kw. Allis Chalmers 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—7½ kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—10 kw. West. SK 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—15 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—20 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—25 kw. Triumph 1750 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—25 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—150 kw. West. 250 v. 900 rpm. Gen. dir. conn. to 290 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.
3—250 kw. Cr. Wh. 250 v. 500 rpm. DC Gens. with 3—250 kva. Cr. Wh. Syn. 220 v. 3 ph. 25 cy. Motors.

125 volts

1—5 kw. 125 v. 1150 rpm. Allis Chal. Gen. dir. conn. to 3 ph. 60 cy. 220/440 v. AC Induction Motor.

WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC MFG. CO. **Pittsburgh 6, Pa.**

TURBO-GENERATOR *Immediate Delivery*

Units Noted Below Are Now In Our Stock—All Are 3 Phase, 60-Cycle, 3600-RPM

7500—KVA. G.E. Sur. Cond., 190/375#: 2300-v.
6250—KVA. G.E. Sur. Cond., 200#, 2300-v.
3125—KVA. G.E. Sur. Cond., 200#, 2300-v.
3750—KVA. G.E. Sur. Cond., 200#, 2300-v.
2500—KVA. G.E. Sur. Cond., 200#, 2300-v.
1875—KVA. G.E., COND. 200#.
1565—KVA. G.E. Sur. Cond. 150#, 2300.
1250—KVA. West. D.C.
1250—KVA. West. Sur. Cond. 200#, 2300.
937—KVA. Allis-C. Cond. 200#.
625—KVA. G.E. Cond. 200#, 2300-v.
375—KVA. G. E. 250-KVA. Non-Cond.

ALSO ALMOST ANY TYPE OR CAPACITY TURBO-GENERATOR DESIRED

Send us Your Specifications—Correspondence Invited

WILMS, WEAVER & CO.—Steam Turbine-Generator Specialists

4045 Penobscot Building — Detroit (26) Michigan

FOR SALE BY OWNER

EQUIPMENT POWER PLANT

TURBO GENERATOR

1—500 KW General Electric condensing generator exciter on shaft, water rate 15.5 per KW hour.

BOILERS

8—600 H.P. Babcock & Wilcox forged steel header Boilers 2—200# pressure—6—225# pressure, A.S.M.E. and National Board.

A number of 600# pressure all steel valves, including non-return valves, outside spring, A.S.M.E.-pop-safety up to 600# pressure. All sizes.

A number of turbine driven boiler feed pumps, oil pumps and ball valve pumps.

We buy complete plants outright

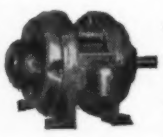
WHAT HAVE YOU FOR SALE?

HOWE BROTHERS

324-328 Pearl St., New York, N. Y.

TEL. WORTH 2-2708-2709-2710

POWER EQUIPMENT COMPANY



OIL—AIR CIRCUIT BREAKERS

4—500 A. GE FK 12 3 PST 15,000 V. Handle. Trip Coils and Currents.
1—800 A. Conduit E4 600 V. 3 PST. Handle. Trip Coils and Currents.
1—1200 A. GE FK 122 A 3 PST 7500. Handle with Trip Coils and Current Transformer.
1—3000 A GE CK 8 Air Breaker 3 PST 600 V. O.L. & U.V.
1—3000 A GE FK 25 Oil Breaker 3 PST 600 V. Solenoid operated with currents.

Sq. Cage—220/440 V. 60 Cy. 3 ph.

Qu.	HP	Make	Type	Speed
2	50	G.E.	KT 327	1800
2	100	G.E.	IK	1800
1	150	West.	CS	1800

Slip Ring—220/440 V. 60 cy. 3 ph.

1	40	West	CW	720
1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200

D. C. Variable Speed 230 V.

1	15	West.	SK	400/1600
1	25	West.	SK	400/1200
1	50	West.	SK	500/1500
1	50	G.E.	CD	400/1600

SEVERAL HUNDRED OTHER ITEMS IN STOCK
ABOVE ONLY SPECIALS—ALL REBUILT—STOCK SHIPMENT

154 ANDREWS ST. — Tel. MAin 568 or 569 — ROCHESTER 4, N. Y.

SYNCH. CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

500 KW G.E. SYN. 250 V. 2300/4000 A.C. 900 RPM
200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK CO.

Incorporated

502 Grant Building, Pittsburgh, Pa.

IMMEDIATE DELIVERY

PUMPS

One Quimby 4 stage Centrifugal pump direct connected to 75 H.P. G.E. motor—220 volts—3 phase, 60 cycle, 1750 R.P.M.—500 G.P.M. 150 lbs. pressure.
One American Well 2 stage Centrifugal pump direct connected to 30 H.P. G.E. motor, 220 v., 3 ph., 60 cy., 1750 R.P.M. 200 ft. head complete with magnetic starter and safety switch.

FEED WATER HEATERS

One Goubert feed water heater with brass tubes —330 sq. ft. heating surface.
One Cochrane feed water heater, 54" dia. x 48" long—1000 H.P. capacity.

BOILERS

One 444 H.P. Union Iron Works, water tube steam boiler 200 lb. working pressure, pulverized coal or oil fired.

STEAM ENGINE

40 H.P. Nagle vertical steam engine, Class F, 12" cylinder, 12" stroke, flywheel 54" x 12½".

EMSCO EQUIPMENT CO.

EMIL A. SCHROTH, Owner

50 Hyatt Ave. — Newark 5, N. J.

Phone Mitchell 2-3536

DIESELS

Fully Automatic
AC-DC Plant
2—Buda LD 909's DC to
2—44 KVA 120-208 V AC
2—25 KW 240 Volt DC
Cost $34,500.

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

DIESEL UNITS

1550 H.P. Elec. Boat Engine
480 KW Cooper Bessemer 2300 V.
300 KVA Fairbanks Morse 2400 V.
250 KW Ingersoll Rand 2200 V.
250 KW Busch Sulzer 240 V.
192 KW McIntosh Seymour 2300 V.
125 KW Cummings 220 V.
100 KW Busch Sulzer 2300 V.
75 KW Superior 2300 V.
75 KW Wolverine 220 V.
50 KVA Fairbanks Morse 2300 V.
12—11,500 & 20,000 Gal. Steel Tanks.

R. C. STANHOPE, INC.

60 East 42nd St. New York, 17, N. Y.

ELECTRICAL EQUIPMENT

FOR

INDUSTRY

LET US KNOW YOUR REQUIREMENTS

MERCURY ARC RECTIFIERS

4—300 KW 250 volts DC General Electric & Westinghouse—used 10 & 4½ months

For Details Write

JOHN D. CRAWBUCK COMPANY

714 Ark Way North Side
Pittsburgh 12, Penna.

SLIP RING MOTORS
3-HP., 60-CY.

HP	Volts	Make	Speed
900	2200	G.E.	900
500	440	G.E. (Hoist)	450
300	440	Al. Chal.	900
300	2200	G.E.	1800
300	400/220	Al. Ch.	900
250	2300	G.E.	600
250	440/550	G.E.	600
250	440	Whse.	450
250	550	Al. Chal.	900
200	2200/440	G.E.	1200
200	2200/440	G.E.	600
150	440	G.E.	1800
150	4000/2300	G.E.	1800
150	2200/440	G.E.	600
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
125	2200	G.E. (New)	1800
100	440/220	G.E.	1800
100	220/440	G.E.	720
100	220/440	G.E.	900
100	440/220	G.E. MTC	900
100	550	G.E.	900
75	440/220	Whse.	720
75	550	G.E.	900
60	2200	G.E.	900
40	2200	Whse.	900
40	2200	G.E.	1200

SYNCHRONOUS MOTORS
3-HP., 60-CY.

300	440/220	Al. Ch.	600
200	2200	Whse.	900
110	440	Whse.	900
100	2200/550	Al. Ch.	1800
100	440/220	G.E.	360
75	440/220	G.E.	720

UNAFLOW ENGINE-GENERATOR SET consisting of:

Gen: 250 KW 200 RPM 250 volt direct connected to:

Eng: 23" x 24" Ames Unaflow 125/150# ga. non-condensing. Very modern—practically new.

1—11" x 12" Ames non-condensing Steam Engine, direct connected to a 60 KW Crocker-Wheeler 250 volt DC Generator.

TRANSFORMERS
60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460.
3—250 kva., Whse., 13,800-460.
3—250 kva., G.E., H-KDD, 13200-2300/575 V.
3—200 kva., G.E., type H, 34500-2300 V.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Ch., type OISC 10400-2400.
3—150 kva., G.E., H-KS, 2400-240/120 V.
2—150 kva., G.E., HTQ, 4150-240/480 V.
3—100 kva., Whse., SK, 4200-460/230 V.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., G.E., type H-KR 6600/11430Y-2300 V.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230-115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	2200/.40	Whse.	CS	720
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E	IK	720
200	440/220	G.E.	IK	900
200	440/220	G.E.	IK	1200
150	440/220	G.E.	KT	720
150	440/220	G.E.	IK	900
150	2200	Allis Ch	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
125	440/220	G.E.	K	514
125	440/220	G.E.	KT (Vert.)	1800
100	2200/440	G.E.	IK	1200
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
75	2200	G.E.	KT	900
75	2300	G.E.	IE-h	1800
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

1—75 KW, 250 V. 850 RPM, conn. to 110 HP, 440/220 V. Sq. Cage Motor.
1—50 KW, 250 V. 850 RPM, Whse. conn. to 75 HP, 440/220 V. 3 ph. 60 cy. Sq. Cage Motor.
1—50 KW., 125 V., 1200 RPM. Whse. conn. to 75 H.P., 2200/220 V., 3 ph., 60 cy., Sq. Cage Motor.

A.C. GENERATORS

1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—187 kva., 900 r.p.m., 550 V. Whse.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 96 kva., 360 r.p.m., 480/240 V., G.E.
1—62½ kva., 1200 r.p.m., 2200 V., Cr. Wh.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

DIESELS

1375 H. P.

McIntosh & Seymour

Diesel Generating Plant

3/60/480—2300

1—1000 K. V. A.

1— 372 K. V. A.

Can be seen Operating

Rebuilt & Guaranteed

ROBERT SCHOONMAKER
Diesel Sales Engineers
Port Washington. Long Island. N.Y.
Phone Roslyn 1220

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

"Export Orders Carefully Executed"

SPECIAL OFFERINGS

1—2000 H.P. B. & W., 200# Boiler
2—1060 H.P. Heine Boilers 200#
4—1000 H.P. Heine 225# Boilers
2— 750 H.P. Edge Moor 200# Boilers
2— 750 H.P. B. & W. Sterling Boilers 200#
4— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
4— 440 H.P. B. & W. Sectional 200# Oil fired
1— 335 H.P. B. & W. Sectional 200#
Smaller Boilers and Fire Tube Boilers also

1—15000 K.W., G.E. Co., Turbo-Generator Condensing
2—12500 K.W., G.E. Co., Turbo-Generator Condensing
1— 5000 K.W., G.E. Co., Turbo-Generator Condensing
3— 4000 K.W., G.E. Co., Turbo-Generator Condensing
2— 2500 K.W., G.E. Co., Turbo-Generator Condensing
2— 2000 K.W., G.E. Co., Turbo-Generator Condensing
1— 2000 K.W., W. E. & M. Co., Turbo-Generator Con.
3— 1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 K.W., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller. And Non-Cond. Units

50 Ton 69'-10" Overhead Traveling Crane.

CHARLES B. REARICK 30 CHURCH ST. NEW YORK

FOR SALE

5000 KVA Turbo Generator Unit

3/60/2300 v. 3600 RPM. 200# 100° SH with 7500 sq.ft. Surface Condenser. In operation, also Boilers.

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York, N. Y.

Motor Generator Sets—Synchronous Motors, Etc.

SLIP RING MOTORS
3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

SYNCHRONOUS MOTORS
3 phase,60 cycle, A. C.

1—Ideal 3-bearing 250 HP 600 RPM 440 Volt
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

VERTICAL MOTORS

1—Reliance fan-cooled 25 HP 1750 RPM 220/440 Volt

D. C. EQUIPMENT, 230 VOLT

1—G.E., MPC 150 HP 262/750 RPM
1—Triumph 110 HP 292/600 RPM
1—Diehl 125 HP 400/1200 RPM
A large nummber of adjustable speed D.C. motors from 5 to 100 HP.

ALTERNATORS SPECIAL, Allis-Chalmers, 125 KVA 277 RPM 3 Phase, 60 Cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

Rot. Con.—M-G Sets 3 ph. 60 cy.

2—300 KW G.E. HC 12 Rotaries 275 v. 6 ph. with 2300 v. ph. 60 cy. Transformers.
150 KW Cr. Wh. 250/275 v. 550 RPM Gen. V Belted to 200 HP West. Syn.
75 KW G.E. 125 v.—220/440 v. 720 RPM.
50 KW G.E. 125 v.—220/440 Ind.
25 KW West. 250 v.—220/440 v. 1200 RPM.

AC and DC GENERATORS

200 KVA G.E. 2200/3/60 720 RPM. AC.
75 KW G.E. 125 v. 700 RPM. DC.
75 KW 250 v. G.E. Type RC 1200 RPM.
50 KW G.E. 125 v. 1750 RPM. DC.
45 KW West. SK 125 v. 700 RPM. D.C.
45 KW 250 v. Cr. Wh. 700 RPM.

AC & DC STEAM GEN. SETS

100 KW West. 250 v. DC—Skinner.
57½ KVA Al. Ch. 220/3/60 3600 RPM Turbo.
50 KW West. 125 v. DC—Skinner.
50 KW 125 v. DC Westgh. Turbo Gen.

AC MOTORS 3 ph. 60 cycle

HP	Make	Type	Speed	Wdg.
1500	West.	CW	435	S.R.
1000	G.E.	KT	514	S.C.
500	G.E.	MT 412	435	S.R.
300	West.	CW	1750	S.R.
200	G.E.	IM	495	S.R.
200	West.	.8 P. F.	900	Syn.
200	G.E.	MT 412	240	S.R.
187	G.E.	IM	600	S.R.
150	West.	CS	585	S.C.
150	West.	CW	375	S.R.
150	West.	CCL	600	S.C.
150	G.E.	IL	600	S.C.
150	West.	CW	585	S.R.
125	Al. Ch.		690	S.C.
100	G.E.	IK	1150	S.C.
100	G.E. (25 cy)	MI 108	490	S.R.
100	Al. Ch.		690	S.R.
100	West.	CI	1750	S.R.
0/12½	G.E.	IM	450/900	S.R.
50	G.E.	KT	1160	S.C.
40	Triumph	TR	1760	S.C.
25	G.E.	KT	1160	S.C.
25	West.	CW	575	S.R.

Also large number of smaller motors.

MISCELLANEOUS

2—170 cu. ft. 100# Pres. Chic. Pneu. 9x8 simplate valve compressors—AC or DC Motor.
1—355 cu. ft. 100# 12 x 10—ER 1 Ing. Rd.
500/700 HP Morse Chain 4.28 to 1.
250 HP Falk Gear 12.7 to 1.
150 HP Nattal 1.6 to 1.

DC MOTORS

HP	Make	Type	Speed	Voltage
230	G.E.	MD109.5	475	500 ser.
175	G.E.	MD8109.5	475	230 ser.
130	G.E.	CO 1812	550	230 ser.
140	West.	MC 90	500	500 ser.
100	G.E.	MD 108	550	230 ser.
100	G.E.	DLC	575	110 cpd.
100	G.E.	RC	950	250 v.
60	West.	SK	1750	250 v.
60	West.	SK	500	115 v.
60	G.E.	CO 2507	600	230 ser.

MOORHEAD-REITMEYER CO. INC., Pittsburgh 19, Pa.

BOILERS

Complete Power Plant consisting of:

7— 500 HP Heine Boilers, 210# pressure.

4— 768 HP Sterling Boilers, 210# pressure.

2—1040 HP Heine Boilers, 210# pressure.

The above boilers complete with super heater, soot blowers, including pulverized fuel equipment, heaters and auxiliaries, and 2—12,500 KW General Electric, 3-60-6600 Turbines with surface condensers, all auxiliaries, designed for extraction. The above plant is ready for immediate shipment and is in excellent condition.

ENGINE GENERATOR SETS

1—150 KW Skinner Uniflow Engine Generator Set A.C.
1—1060—KVA Nordberg Uniflow Engine Generator.

TURBINES

2—5000 KW Westinghouse 3600 RPM 3-60-2300 volts Condenser, all auxiliaries.
1—3200 KW Allis-Chalmers Condensing Turbine with auxiliaries.
15,000 KVA Westinghouse turbine, condenser.
1—250 KVA Walte Turbine either condensing or non-condensing.

DIESEL ENGINES

1—200 K.W. Fairbanks-Morse Full Diesel Engine Generator.
1—200 KW Fairbanks-Morse Full Diesel.
1—350 KW Busch Sulzer 3-60-2300 Volt, all auxiliaries.
1—Busch Sulzer Full Diesel direct connected 1335 KW AC generator, rebuilt and guaranteed.
1250 KVA Nelseco engine generator.

ENGINE GENERATOR SETS

1—500 KW Non Releasing Corliss, 3-60-240 volts.
2—400 KW Skinner Uniflow, 3-60-440 volts.
1—625 KVA Bates Corliss engine.
1—10' diameter by 140' high Self Supporting Stack.

MISCELLANEOUS

90,000 pound Cochrane Hot Process Lime & Soda Softener.
2500 HP Cochrane Open Feed Water Heater.
1—10' x 15' Illinois Forced Draft Chain Grate Stoker.
2—6 Retort Taylor Stokers. First-Class condition.
2—300 HP Westinghouse Underfeed Stokers, rebuilt.
1—900 HP Hoppes open feedwater heater.
2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.
1—232 GPM Centrifugal Boiler Feed Pump, turbine driven, 1200 ft. head.

SEE Fletcher FIRST!

FLETCHER SALES CO.
325 Fincastle Building LOUISVILLE, KY.

4000 K.V.A. COND. OR NON COND. TURBO.

WITH COND.—4100 V.—2300 V., 60 Cy., 3 Ph.
2—4166 GPM. 162' HD. CENT. PUMPS (PRAC. NEW), 12" SUC.—12" DISC.
36000-25000 GPM. 27'-40' HD. CENT. PUMP 42" SUC. 36" DISCHARGE
20" AND 24" VALVES—ELLS—TEES—(PRAC. NEW)
1500 CFM 2 STAGE AIRCOMP. 275 HP. 60 CY. 2200 V. SYN. MOTOR
WATER WHEELS—WESTERN SHIP
1625 HP. 240 RPM. 1600 HP. 550' HD. 1500 HP. 150' HD.
725 HP. 160' HD. 310 HP. 450 RPM, WITH AC GENERATOR
425 KVA. 2200 V. GEN. DIR. 60' HD. 500 HP. 35 HEAD 300 RPM.
WOODWARD GOV. SIZED-VERTICAL AND PULLS

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

SLIP RING MOTORS

20 H.P.	900 RPM.	3/60/220 V.	Westinghouse
30 H.P.	1200 RPM.	3/60/220 V.	Fairb'ks Morse
30 H.P.	900 RPM.	3/60/220 V.	Allis Chalmers
35 H.P.	1200 RPM.	3/60/440 V.	General Elec.
40 H.P.	1200 RPM.	3/60/220 V.	General Elec.
50 H.P.	600 RPM.	3/60/440 V.	Allis Chalmers
75 H.P.	1800 RPM.	3/60/220 V.	Wagner
125 H.P.	360 RPM.	3/60/440 V.	General Elec.
150 H.P.	514 RPM.	3/60/220 V.	Allis Chalmers

SQUIRREL CAGE MOTORS

40 H.P.	1200 RPM.	3/60/220 V.	Westinghouse
40 H.P.	900 RPM.	3/60/440 V.	Allis Chalmers
50 H.P.	900 RPM.	3/60/440 V.	Lincoln
50 H.P.	600 RPM.	3/60/440 V.	General Elec.
60 H.P.	1200 RPM.	3/60/440 V.	General Elec.
60 H.P.	900 RPM.	3/60/220 V.	General Elec.
75 H.P.	3600 RPM.	3/60/440 V.	General Elec.
150 H.P.	380 RPM.	3/60/440 V.	Westinghouse

Rockford Electric Equipment Co.
721 South Wyman St. Rockford, Illinois

—TRANSFORMERS—

BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

A. C. TURBINES

2—300 KW GENERAL ELECTRIC ALTERNATORS type ATB, form T, .80 P. F., 375 KVA 3/60/2300 volt, 3600 RPM, 94 Amps. Direct connected to:—
CURTIS TURBINES non-condensing, 175 lbs. type L-25"—2 stage, form C, serial #19177—#19178.

FOR IMMEDIATE DELIVERY
IN A-1 CONDITION

ALJON ELECTRIC DIESEL CO.
151-55 Washington St., Brooklyn 1, N. Y.
Main 4-3804

FOR SALE

2—Motor Generators, 3 phase to 110 volt, D.C. output, 75 and 90 KW—Perfect condition.

also

1—100 KW 900 RPM Alternator, various diesel and steam generating units, industrial and marine.

1—Steam reciprocating 50 K. W. 110 volt D. C. Marine Set.

Arnessen Electric Co.
116 Broad St., New York 4, N.Y.
Bowling Green 9-8542

PUMPS

Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston

STEAM PUMPS—Duplex - Simplex Reconditioned and guaranteed

BOILERS—stacks—Engine Generators—condensers.

LOU COHEN & CO.
1030 N. 6th St. St. Louis 1, Mo.

VALVES

INDUSTRIAL & MARINE
METROPOLITAN
PLUMBING SUPPLY CO., INC.
Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
313 EAST 31st., NEW YORK CITY
For Hourly Nationwide Shipments
CALL MUrray Hill 3-3408
SKETCH PIPE & FITTINGS

BOILER SPREADER STOKER

(1) 600 H.P. Stirling water tube, 160#, 125 degree superheater, spreader stoker.

H. P. BREARLEY
3423-91st St., Jackson Heights, N. Y.

STEAM PUMPING ENGINES

1—Snow 8 MGD C&FW cr. Com. Opp. Type Cond. 28x54x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterworks type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All fine cond.
1—Platt Iron Wks. Cr. Comp. C&FW Meyer Valve Gear Cond. 1000 GPM. Size 14x28x9¼"x18.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt, 100#.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago, Ill.

FOR SALE

2—Erie water tube boilers, 405 HP each, located at Brownsville, Pennsylvania
1—Springfield water tube boiler, 300 HP, located at Chattanooga, Tennessee

Still erected, complete with stokers, water heaters, pumps, valves and fittings, last pressure allowed 160#.

Can quote bargain prices. Must be moved at once.

Can furnish new and guaranteed used pipe, valves, fittings, wood and steel tanks and steel buildings.

Jos. Greenspon's Son Pipe Corp.
NATIONAL STOCK YARDS
St. Clair County, Illinois

DIESELS

630 H.P.
FAIRBANKS MODEL 33
6 CYLINDER 14 x 17 300 RPM
DC TO
545 KVA 2300 VOLT

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

TRANSFORMERS

New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.

ATLANTIC TRANSFORMER CO.
Transformer Specialists
5143 N. 2nd St. Phila., Pa.

COMPRESSORS

Over 150 in stock
New and Guaranteed Rebuilt
Modern Plant doing Modern Rebuilding
From 50 CFM to 2500 CFM

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 48th St., North Bergen, N. J.

Reconditioned Motors, Generators, Control Equipment, etc.
Send for 32 page stock list.
Electric Apparatus Repair Company
Specialists on Rebuilding Motors, Generators and Controls
1410 No. 6th St., PHILA., PA.

DIESELS

ALL SIZES-TYPES
A. G. SCHOONMAKER CO.
50 CHURCH ST. PHONE WORTH 2-0455
NEW YORK 7, N. Y.
BUSINESS ESTABLISHED 1898

1—440 HP Elec. Machinery, 3-60-440V, 900 RPM, two bearing syn. motor
1—400 HP Westinghouse, type CW, 3 ph. 60 cy. 440V, 450 RPM slip ring motor
1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type Mt 412 slip ring motor
1—275 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor
1—200 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1150 RPM slip ring motor
1—200 HP Westinghouse, 3-60-2200V, 600 RPM syn. #4956114, direct conn. exciter & starter
2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM
1—100 HP Westingrouse, type CCL, 3 ph, 60 cy. 2200 V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy. 220V, 580 RPM slip ring
1—100 HP General Electric 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter
1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage
4—75 HP G. E. 3-60-2300V, 400 RPM, type I, sq. cage
1—75 HP General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 105C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 3 ph, 60 cy, 3 phase, 440V, 600 RPM Squirrel Cage
2—75 HP Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM
1—50 KW factory built m-g set, 125 Volt, Ideal 900 RPM, driven by 75 HP. sq. cage 220/440 V. motor
1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K
1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 556 slip ring motor
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring
1—50 HP Triumph 3-60-440V, type C12 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers, 3-60-440V, 890 RPM slip ring
1—50 HP General Electric, 3-60-440V, 690 RPM, MT 546, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM Sq. Cage
1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring
1—45 KVA Fairbanks-Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 2220V, 3600 RPM, type HO, frame 12B ball bearing
1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC, driven by 75 HP, 3 phase, 60 cycle, 220 volt, 1165 RPM motor
2—175 HP, 230V, DC Westinghouse, type SK, 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SKI40L, 115V, 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM

THE WENTE ELECTRIC CO.
Hamilton, Ohio
Rebuilt Motors & Generators Since 1906

NEW & REBUILT
NATIONAL SERVICE
phone us COLLECT
ELECTRIC EQUIPMENT CO.
63 CURLEW ST. . . . ROCHESTER 1, N. Y.
P. O. Box 51 . . Phone: GLenwood 6783-4-5

• SPECIALS •

1000 KW. 250 v. steam engine generator set

500 KW. 250 v. 900 RPM Syn. M. set 2200 v. 60 cy. 3 ph. AC drive with complete control. Delivery in 3 weeks. GUARANTEED REBUILT

500 KW. DC M.G. 600 v. DC 900 speed, Allis Chalmers. For any AC voltage drive

400 KW. 3 unit 250/500 volt Gen. Elec. Syn. M. G. set, 2300/4000 volt AC drive

120 KW. 250/500 v. DC gasoline engine gen. set

100 KW. 125 volt, G.E., 1200 rpm. M.G. set any AC volt

70 KW. M.G. Set 70 v. 1000 Amp. Burke, syn. drive

(3) 667 KVA. Trans., 23,000 volt pri. 440 v. sec. 60 cy. single phase

35 KW. 125 v. M. G. set. For any AC voltage drive

50—New 3 HP. G.E. 1800 rpm. 220 volt slip ring motors

5—200 HP. Westinghouse type CS' 2200 volt, 60 cycle, 3 phase, 1200 rpm. X.P. motors, NEW

100 KW. 125/250 volt, 1200 rpm. General Electric synchronous rotary converter

300 KW. 250 v. West. 900 rpm. syn. rotary converter

Phone us collect, station to station, on your requirements. Tell the telephone operator who is calling and the reason for the call.

ELECTRIC EQUIPMENT CO.
BOX 51, ROCHESTER, N. Y.
PHONE GLENWOOD 6783

SEARCHLIGHT SECTION

PUMPS MOTOR & STEAM DRIVEN

G.P.M.	Head	Make	Type
9700	110′	Ing. Rand	Centrif.
6000	33′	LeCourtenay	Centrif.
3500	140′	Kingsford	Centrif.
2400	55′	American	Centrif.
1100	220′	Allis-Chalm.	Centrif.
1500	160′	De Laval	Centrif.
400	625′	LeCourtenay	Centrif.
250	525′	LeCourtenay	Centrif.
400	350′	Goulds	Triplex
300	500′	Goulds	Triplex
175	500′	Goulds	Triplex
500	175′	Blackmer	Rotary
450	231′	Kinney	Rotary
300	150′	Viking	Rotary
1000	460′	Knowles	Steam
750	460′	Snow	Steam
500	460′	Snow	Steam
2000	50′	Lawrence	Sump
300	231′	Gardner	Plunger

M. G. & STEAM DR. SETS

K.W.	Make	Volts	Type
25	Green Eng.	220 D. C.	Beld Drive
100	Ames	240 D. C.	dir. dr. Eng.
75	Ames	240 D. C.	dir. dr. Eng.
17	Sturt. Turbine	110 D. C.	Direct Drive
7½	Sturt. Turbine	110 D. C.	Direct Drive

D.C. MOTORS ALL SIZES

100 Northwest	220	1750
25 Roth	230	1750
10 Crock. Wheel	110	925
10 Weeshge	110	1700

1½ to 7½ H. P. ALL MAKES

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 26000EDR
Nash-Jenn Simp. Vac. Heat. 16000EDR
Condensation Units, 100 to 250,000EDR

AIR COMPRESSORS

G.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ing. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
140	125	Curtis	Vert. Dup
125	100	Gardner	Vert. Dup.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

1800	5¼ lbs.	In. Rand	Motor dr.
900	10½ lbs.	In. Rand	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24–45 oz.	Spencer	Motor dr.
250	3.2 lbs.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS & EXHAUSTERS

C.F.M.	St. Pres.	Make	Type
100–60000	½″–5′	Buffalo	Various
100–15000	¼″–16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
500	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Direct dr.
110	15 lbs.	Beach R	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth	Belt dr.
100	high vac	Beach R	Gear dr.
100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn
150	West.	440	700	CS
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	
60	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CS
40	G.E.	220	870	342
30	Wagner	220	850	SI. rg.

Also 10 to 30 H.P. in All Makes

STEAM ENGINES

Turb. Cent. Bronze Pumps
Steam Pumps—All Sizes
10″x10″ Greenfield Vertical
7″x7″ Wickes Bros. Vertical
6″x8″ Vertical & Smaller
1 to 40 H.P. Steam Turbines

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.

138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

IMMEDIATE DELIVERY

ELECTRIC MOTORS

Direct Current—230 Volts

1—10 HP Crocker-Wheeler—Type CM—825 r.p.m.
1—10 HP Crocker Wheeler—Type CCM—825 r.p.m.
1—10 HP Crocker Wheeler—Type CM—870 r.p.m.
1—15 HP Crocker Wheeler—Type CM—800 r.p.m.

Direct Current—115 Volts

1—25 HP Westinghouse—Type S—630 r.p.m.
1—17.5 HP Crocker Wheeler—Type CM—340 r.p.m.
1—10 HP Crocker Wheeler—Type CCM—1750 r.p.m.
1—10 HP Crocker Wheeler—Type CM—880 r.p.m.
1—20 HP Crocker Wheeler—Comp.—1200 r.p.m.
1—7.5 HP B.F. Sturtevant—Type MP4—550 r.p.m.
1—7.5 HP Crocker Wheeler—Type CM—875 r.p.m.
1—3.75 HP Crocker Wheeler—CM—440 r.p.m.
1—6 HP Crocker Wheeler—Type EM—960 r.p.m.
1—5 HP Sprague Elec. Co.—Slip Ring—520 r.p.m.
1—5 HP Crocker-Wheeler—Type CM—950 r.p.m.
1—5 HP Sprague Electric Co.—Lundell Motor Cont. —1050 r.p.m.
1—4 HP Sprague Electric Co.—Lundell Motor Cont. —815 r.p.m.
1—4 HP Crocker-Wheeler—CCM—1375 r.p.m.
1—2 HP Holtzer & Cabot Elec. Co.—Type C—250 r.p.m.
1—2 HP Sprague Elec. Co.—Lundell Motor Cont.— 800 r.p.m.
1—¾ HP Crocker-Wheeler—Type SM—600 r.p.m.
1—1/3 HP Sprague Elec. Co.—Type RT—725 r.p.m.
1—3 HP Western Elec.—Type CVC Shunt—1100 r.p.m.
1—1 HP Crocker-Wheeler—Type CM—1200 r.p.m.
1—2 HP Crocker-Wheeler
1—½ HP Crocker-Wheeler—Type CM—550 r.p.m.
1—2 HP Sprague Elec. Co.—Lundell Motor—1150 r.p.m.
1—1.7 HP Crocker-Wheeler—Type CM—1100 r.p.m.
1—2 HP Crocker-Wheeler—Type CM—1487 r.p.m.
1—7.5 HP Crocker-Wheeler—Type CM—385 r.p.m.

MISCELLANEOUS

Induction Type—220 V.—2 Ph.—60 Cy.

1—5 H.P. Burke—Type EB 5—1130 R.P.M.
1—5 H.P. Burke Type—EB 75—900 R.P.M.
1—7½ H.P. Robbins & Myers—Type K—850 R.P.M.
1—10 H.P. Burke—Type EM 1.2—900 R.P.M.
2—20 H.P. Burke—Type EM 3—1200 R.P.M.
1—20 H.P. Crocker Wheeler—1170 R.P.M.
1—35 H.P. Burke—Type EM—4.5—900 R.P.M.
1—50 H.P. Burke—Type EM—4.5—1200 R.P.M.
1—150 H.P. West—Type CW—1765 R.P.M.

GENERATORS

One 250 K.V.A. and one 300 K.V.A. Crocker Wheeler Generators direct connected to Skinner Tandem compound engines—480 volts—3 phase 60 cycle, switchboard, instruments, piping.

One 300 K.W. General Electric Generator, 2300 v., 3 ph., 60 cy., direct connected to Curtis Steam Turbine, 175 lbs. pres.—3600 R.P.M. with 15 K.W. G.E. direct connected exciter.

EMSCO EQUIPMENT CO.

EMIL A. SCHROTH, Owner

50 Hyatt Ave. Newark 5, N. J.

Phone Mitchell 2-3536

POWER PLANT

1—250 HP. Boiler 160#, with spreader type stoker. Prac. new condition.

1—312 KVA 4-valve Engine Set and 1—187 KVA Engine Set. Both 440/60/3. Piping, valves, and auxiliaries.

ROSS POWER EQUIPMENT CO., Indianapolis 4, Indiana

NEW and USED EQUIPMENT AVAILABLE

for

Power Plants, Sub-Station, Transmission Lines and Construction

Send for new list . . . to

—APPARATUS EXCHANGE—

EBASCO SERVICES INCORPORATED, TWO RECTOR ST., NEW YORK 6, N. Y.

FOR SALE

60 HP model 34 Fairbanks Diesel, 800 RPM, with marine transmission.
60-120-240-360 HP Fairbanks Y-VA engine generator sets, 257 RPM.
420 HP 14x17 Fairbanks, 300 RPM, with clutch
125-165-365 HP Busch-Sulzer with generators.
120-140-200 HP Atlas Diesels, no generators.
80 & 240 HP Anderson Diesels, 14x18 with gen.
30 KW 125 volt Ridgeway steam engine generator set.
35 KW 125 volt Chuse steam engine generator set.
125 KVA Ridgeway 3/60/2300 vt. steam generator set.
125 KW Ridgeway 115/230 vt. steam generator set.
400 KW Allis-Chalmers 3/60/220-440 vt. generator set.
3—48″ Sirocco Multiblade Blowers, No. 9.
3—40″ Sirocco Multiblade Blowers, No. 8.

GENERAL MACHINERY & EQUIPMENT CO., INC.

801-15 Woodland Ave., Kansas City 6, Mo.

FOR SALE

1 New McAlear Valve

Body—Semi steel flgd. end globe FF6D per 125# A.S.A. std.
Trim—Bronze std. plug, seat rings & trim.
Initial steam pressure—100#
Reduced Steam pressure 15# to 30#
With ⅛″x11″ diaph.—steam service 2½″x ½″x9″ spring.

The price will be $195.00

PRODUCER-CANNERS' COOPERATIVE, INC.

NORTH COLLINS, NEW YORK

BOILERS

(2) 400 H.P. (each) single set, box header, longitudinal drum, water tube 160# with underfeed side dump stokers, piping, valves, pumps.

H. P. BREARLEY

3423-91st St., Jackson Heights, N. Y.

DIESEL GENERATING SETS

50 HP Superior 3/60/120/208
10 KW General Motors . . 3/60/240/480
Both are modern and compact with all accessories, completely rebuilt; can be seen operating. Immediate delivery.

CROWLEY-DUERS CO., White Plains, N. Y.

SPECIAL BOILER BARGAIN

130 HP Ames horizontal fire box economic type boiler, self-contained, ASME, inspection guaranteed for 105#, complete with stack and standard fittings.

THE ACME EQUIPMENT CO.

14057 Schaefer Highway, Detroit 27, Mich.

BOILER

Heine Boiler 360 HP, Code Stamped 167# pressure. Full Trim. Hartford Insured. Immediate delivery. Missouri shipment.

F. W. HAY & COMPANY

2732-34 Cherry Street
Kansas City, Missouri, Zone 8

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY

Jackson, Miss.

FOR SALE

125 KVA Allis Chalmers turbo generator, 3600 R.P.M., 440 or 220 volts, three phase, 60 cycle. Steam pressure, 125#, 5# back pressure.

Consolidated Badger Cooperative

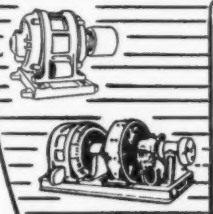
Shawano, Wisconsin

NEW AND USED

ELECTRIC STEAM and AIR EQUIPMENT

WRITE OR WIRE YOUR NEEDS TO

BENJAMIN'S RELYABILT EQUIPMENT



- One of the most complete varieties of A/C and D/C electrical equipment ever assembled under one roof . . . thousands of items in stock and built to specifications from 1 to 500 KW.
- We stock used equipment in 1, 2 and 3 phase sizes from 1 to 5000 H.P. . . . all

THOROUGHLY OVERHAULED
rebuilt—tested—approved—guaranteed for one year.

AGENTS FOR: CROCKER-WHEELER, BROWN & BROCKMEYER, U. S. ELECTRIC TOOL CO., WESTINGHOUSE AIR BRAKE, "SCHRAMM" and others.

Benjamin's for Motors

ESTABLISHED 1904

Windsor 5-1700

3614 12th AVENUE ★ BROOKLYN 18, N. Y.

FOR SALE

SURPLUS EQUIPMENT

One 150 KVA, 2300 volt, 3 phase, 60 cycle, Engine Generator Set, complete with switch board, automatic overspeed quick acting throttle, voltage regulator, steam receiver and water eliminator. This is a complete unit in excellent operating condition now installed at our plant.

For complete description and prices wire, telephone or write

FARLEY & LOETSCHER MFG. CO.

DUBUQUE, IOWA

WURTH for "WORTH"!

A.C. GENERATORS 3 PHASE—1 PHASE 15 TO 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS

Send For Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY

Motors, Generators, Alternators, Frequency Changers.

141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

STEAM GENERATOR SETS

1—50 KW Engberg Vertical 125 volt DC, 416 Amps. 300 RPM, 100 lbs. pressure, Flywheel governor.
3—35 KW Sturtevant Vertical 125 volt DC, type VS7, 10x9, 100 lbs. pressure Flywheel governor.
2—35 KW Westinghouse Turbines 125 volt DC, 100 lbs. pressure.

Immediate Delivery — Excellent Condition

ALJON ELECTRIC DIESEL CO.
151-55 Washington St., Brooklyn 1, N. Y.
Main 4-3804

APPLICATION ENGINEERS

(3) 160 HP 240 volt AC diesel Gen. sets complete plant.
(4) 3000 HP variable speed slip ring motors.
(1) 350 HP 240 volt Fairbanks Morse diesel set.
(1) 96 & (1) 49 KW 240 volt AC uniflow engine
List without charge surplus equipment.
Send specs covering your needs.

HOWARD BLAINE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Illinois

PIPE

CUT TO SKETCH ⅛" to 24"

METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
LARGE SURPLUS STOCK
STEEL-WROUGHT IRON-CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves

313 East 31st Street, N. Y. C.
HOURLY NATION-WIDE SHIPMENTS
Phone MUrray Hill 3-3408

FLANGED VALVES & FITTINGS

DIESELS

BUCKEYES

3—262 H.P. "E" 175 K.W.
1—240 H.P. "P" 150 K.W.
1—190 H.P. "70" 120 K.W.
3—150 H.P. "E" 125 K.W.

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

FOR SALE

1—Wing Blower.
6—Enco Oil Burners with wall boxes et cetera. 1,000 HP Nominal. Twin Safety Valves, Main Stop Valves. Piping and fittings.

RUSSELL B. HOBSON
Great Notch, N. J.

FOR SALE

2—300 KVA AC Gens. D/C Full Diesels
1—290 HP Sterling Gas or Gasoline Eng.
1—125 KW 240 V. Gen. D/C Unaflow Eng.
1—150 & 100 KW 3-Wire Eng.-Gen. Sets
1— 50 KVA AC Gen. D/C Steam Engine
1— 15 & 25 Ton 50' Span OET Cranes
1— 25 KVA 110-220 V. Caterpillar Plant

H. & P. MACHINERY CO.
6719 Etzel Avenue — St. Louis 14, Mo.

FOR SALE

1. General Electric horizontal generator—600 KVA-480 KW-440/3/60, 788 amps, 200 rpm, form AL, type ATB, 36-800-200—Serial No. 1012494. For direct connection to horizontal shaft.
2. Separate belt driven exciter—15 KW General Electric, 125V—120 A—750 rpm—form A, type RC12, serial No. 646886.
3. General Electric horizontal generator—500 KVA, 400 KW 440/3/60, 658 amps, 180 rpm, Spec. #16313, form A, type ATB 40-500 KD. Serial No. 58106.
4. Separate bet driven exciter 15 KW General Electric, 125 V. 120 amps, 750 rpm, form A, type RC12, Serial No. 648916.

Both generators recently rewound

HOLYOKE WATER POWER CO.

Holyoke, Mass.

BOILERS

(2) single set, cross drum, sectional steel header, water tube, 160#, 404 H.P. (each) with oil burners and stop valves.

H. P. BREARLEY
3423-91st St., Jackson Heights, N. Y.

FOR SALE

One Brine Cooler—Six Pass—horizontal steel tubes
One Hayward Clamshell Bucket Type "E" ¾ yd. cap.
One 10" Centrifugal Pump
One 12" Centrifugal Pump
Also steam pumps, valves, etc.

W. L. BROADDUS
Hopewell, Va.

FOR SALE

1—300 HP Y V F & M Engine. Will sell for spare parts.
3—240 HP Y V A F & M Engines direct connected to 200 KVA Generators, Board & Starting.
1—100 HP Y V F & M with Generator.
3—120 HP Y V A F & M with or without Generators.
3—360 HP Allis Chalmers Gas Engines with Generators & Boards.
6—14 x 17 Y V A F & M Cylinders, Pistons & Heads.
Generators 50 KW up.
Oil, Gas & Steam Engines 50 HP up.

A. C. ASKEW
Box 3073 Whittier St., Tulsa, Okla.

POWER EQUIPMENT

SLIP RING MOTORS

Three Phase, 60 Cycle

HP	Speed	Volts	Make	Type
300	600	440	G.E.	IM-3 brg.
300	600	440	Whse.	CW
100	900	220/440	Whse.	CW
75	900	220/440	G.E.	ITC-5013
*60	350	220/440	G.E.	MT-504Y
52	900	220/440	G.E.	ITC-5012
50	900	220/440	Howell	SR-446
40	1200	220/440	G.E.	MT-336
40	900	2200	All. Ch.	ARY
40	900	220/440	Whse.	CW-568A
40	720	220/440	G.E.	MT-346
35	1200	220/440	El. Mach.	SK
30	1800	220/440	G.E.	MT-523
30	1800	2200	Whse.	CW-565C
30	900	220/440	G.E.	ITC-5011
30	900	220/440	G.E.	KH
25	1800	220/440	G.E.	I-M
25	1200	220/440	G.E.	MT-522
25	900	220/440	Watson	KE
25	550	220/440	Watson	KH
20	1800	220/440	G.E.	MT-503
20	720	220/440	G.E.	MT-336
10	1200	220/440	Whse.	CI-W326Z
10	1200	220/440	Otis	INT

* Gear head motor.

VARIABLE SPEED DC 230 VOLT MOTORS

Qu.	HP	Speed	Make	Type
1	3/4	500/1800	G.E.	BD-35
3	1	500/1500	G.E.	BD-47
1	1½	850/2250	G.E.	B-254
1	100	900/1100	G.E.	DLC

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle

HP	Speed	Volts	Make	Type
60	1200	220/440	G.E.	KT-343
50	720	220/440	Whse.	CS
40	1800	220/440	Wagner	VRP
40	900	220/440	G.E.	KT-536
40	720	220/440	G.E.	KT-342
35	900	220/440	G.E.	KT
30	1800	220/440	F.M.	B
30	900	220/440	Whse.	CCL
25	1200	220/440	G.E.	KT-326
*20	1200	220/440	G.E.	KT-312
*20	1200	220/440	G.E.	KT-512
20	720	220/440	Wagner	BP

* Five of each available.

TURBINE GENERATOR SETS

2—75 KVA, 3 phase, 60 cycle, Allis Chalmers, 3600 RPM, direct connected to Moore Steam Turbines, 150 PSI 8 lbs. back. Will wind for any AC voltage.

M. G. SET

1—Western Electric, 30 KW, 240 V. DC, 50 HP, 220/440 volt, 3 phase, 60 cycle, 1800 RPM motor on CI base plate.

HAND STARTING COMPENSATORS

15—20 HP CR1034-K1, 440-3-60.
20—25 HP CR1034-K1, 440-3-60.

AIR RECEIVERS

1—36" x 8', 150# double riveted vertical stand.
2—18" x 6', 300# double riveted vertical stand.

Electrical Engineering and Equipment Co.
1201 WALNUT STREET — DES MOINES 7, IOWA

TWO RILEY STOKERS

6—Retort, Underfeed, 9'-6¾" wide by 11'-2¾" long. Complete with 440 volt motors and forced draft fans. In good operating condition.

HENRY VOGT MACHINE CO.
Louisville 10, Ky.

For Immediate Delivery

UNAFLOW ENGINE SET

1—166 KVA. Allis Chalmers Alternator 3 phase, 60 cycle, 200 Amperes, 480 volts (Can be reconnected to 240 volts,) direct connected to 16" x 18" Ames Unaflow engine, left hand, side crank, 225 RPM., 165# steam pressure condensing or non-condensing. Floor space —15' long x 12' wide. Complete with exciter and panelboard.

FS-845, Power
330 West 42nd St., New York 18, N. Y.

BOILERS

NEW and USED

All makes & sizes for prompt shipment

Special Offer
400-HP....175 lbs.
Stirling Boilers

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO
Telephone Harrison 0755

FOR SALE

75 horsepower, high pressure, Scotch Marine Boiler. Seven years service. Hartford Insurance tested, in excellent condition.

York Ice Machine, 8 x 8, twin cylinder, 50 horsepower, synchronous motor, complete with condenser, valves, switchboard, starting converter, water pump, etc., all in good condition.

Reason for selling, retiring from business.

HARRY M. RIGHTER
9310 Lorain Ave., Cleveland 2, Ohio
ATlantic 1160

FOR SALE

Engine & Generator

COMPLETE

Engine — Cross compound Ball Engine Serial No. 447.
Generator — Westinghouse—250 KW, 440 Volts, 3-phase, 60 cycle, 150 RPM, Serial No. 450856.
Both Engine & Generator in A-1 Condition.

FORD ROOFING PRODUCTS CO.
111 W. Washington St., Chicago 2, Ill.

4—150 H.P. HRT boilers, 130# pressure.
1—502 H.P. B & W Sterling Class 0-20 ASME 200# pressure complete with Riley pulverizer.
1—175 H.P. Freeman Scotch Marine Boiler, 130# pressure.

NELSON MACHINERY COMPANY
Green Bay, Wis.
HOME OF THE "PACKERS"

TRANSFORMERS

3—100 KW GENERAL ELECTRIC, Form K-6 2400/120/240/115/230, overhead type H, Excellent condition.

A. METTLER
151-55 Washington St., Brooklyn 1, N. Y.
Main 4—3804

SKINNER STEAM ENGINE

16 x 15, left hand, center crank automatic engine, Belted type with special extended shaft and outboard bearing. 275 R.P.M. under pressure 70 to 80 lbs. at throttle, zero to 5 lbs. back pressure. Weights for governor so speed can be reduced to 150 R.P.M. Engine built to run under. This engine in good running order and will be sold cheap.

TRIANON LANES
9802 Euclid Ave. Cleveland, Ohio

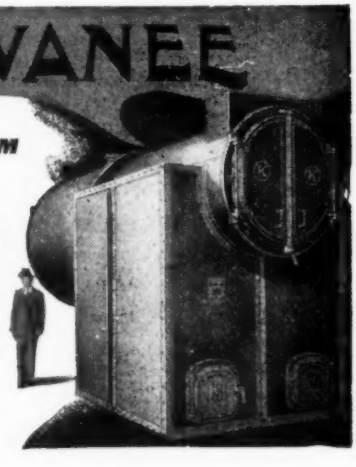
HI-TEST KEWANEE

FOR POWER and PROCESS STEAM

6 Sizes . . . 50 to 150 H.P. . . . 125 to 150 lbs. W.P. A quick steaming all-welded portable boiler with refractory lined firebox and 2-pass tubes to save fuel.

75 Years Boilermakers

For 6" scale with pipe diameter marking, write Department 89-K-6.



KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

B. F. Sturtevant

ENGINE GENERATOR SET

75 K.W., 115 v., D.C., 652 amp. 275 rpm. GENERATOR #4175, Type C, Form E. ENGINE: #11989, Type H.C.I., 14x14", 100 psi. 275 rpm.
Fred J. Anderson, Supr. Bldgs. & Gr. School City of Elkhart, Elkhart, Ind.

FOR SALE

One good Auburn Stoker Model No. 48, Serial No. 1600 with 5 HP A.C. Motor and Force Air Fan. Now used on 150 HP, HRT Boiler. 6 x 6 Grate Area.

PHYSICAL CULTURE HOTEL
Dansville, New York

Get "on the beam" ...with PLIBRICO

YES, the Plibrico way is "on the beam" to longer refractory life . . . uninterrupted boiler operation . . . minimum manpower losses. For whatever the requirement—repairing, relining, or a new setting—Plibrico Jointless Firebrick gives you a solid, monolithic lining . . . a lining which far outlasts fire brick for the obvious reason that Plibrico eliminates the thousands of joints which sound the ultimate doom of every laid-up lining.

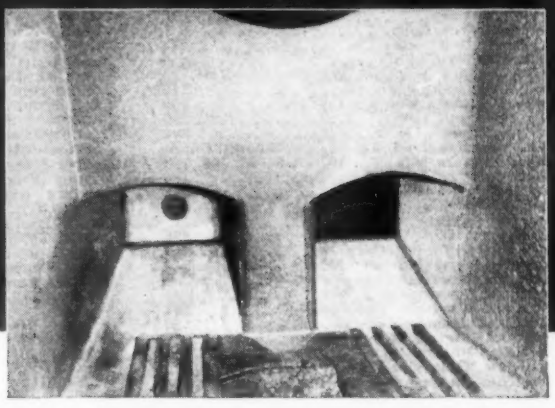
And the Plibrico way is the direct route to greater steam power through increased combustion efficiency and higher boiler capacity. Plibrico engineering service will improve your furnace and arch design, correct your baffle arrangement, modernize your boiler settings.

Plibrico has a way of saving time and dollars on every job. It is readily adapted to all types of boilers and fuel-burning equipment. It effectively forms the front-door arches of hand-fired boilers and the suspended arches of stoker-fired boilers. Equally well it forms the cones for oil, gas and pulverized fuel burners. The most extreme conditions are met by Plibrico sectionalized, air-cooled walls.

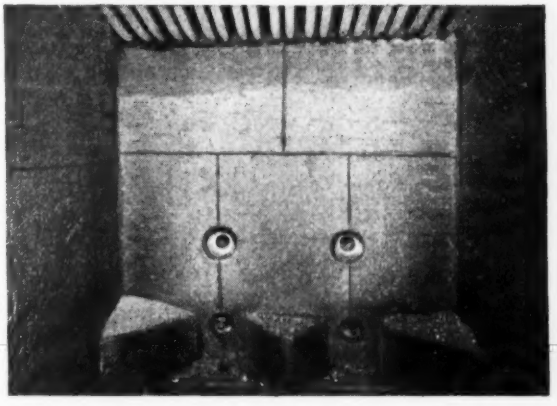
In over 100 cities in the U. S. and Canada, the Plibrico sales and service organization will show you how to get on the beam and stay on the beam with Plibrico refractory products. They furnish complete installation and boiler setting service, or your own maintenance men can install Plibrico products. Ask for our catalog, specifying book covering water tube or H.R.T. boilers.

PLIBRICO JOINTLESS FIREBRICK COMPANY
1818 N. Kingsbury St. Chicago, Illinois

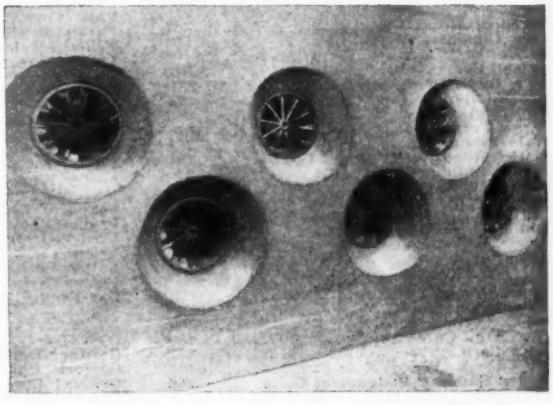
PLIBRICO *Jointless* **FIREBRICK**



For coal-fired boilers: In connection with coal-burning boilers, Plibrico is widely used for door arches, grate line repairs, and bridge walls in addition to complete linings.



For oil-burning boilers: Monolithic Plibrico construction stands the gaff of oil firing as this installation testifies in connection with a 300 hp. Erie City boiler.



For gas burners: Linings involving gas burner cones are readily constructed with Plibrico as this installation illustrates in connection with a 1000 hp. gas-fired boiler.

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues.

Adams Co., R. P. 229
Aircraft & Diesel Equipment Corp. 172
Airetool Mfg. Co. ..... *
Air-Maze Corp. 273
Air Preheater Corp. ..... *
Air Reduction Sales Co. 276
Airtherm Mfg. Co. ..... *
Air Transport Ass'n of America for Railway Express Agency 146
Ajax Flexible Coupling Co. 150
Alco Products Div. 266
Aldrich Pump Co. 322
Allen-Sherman-Hoff Co. ..... Second Cover
Allis-Chalmers Mfg. Co. 18, 47, 54-55, 169, 181
Allpax Co. 188
American Blower Corp. 245
American Brake Shoe Co. ..... *
American Brass Co. 125
American Chain & Cable Co. 338
American Chimney Corp. 364
American Coal Burner Co. 346
American District Steam Co. 192
American Engineering Co. 28-29
American Flexible Coupling Co. 264
American Locomotive Co. 266
American Metal Hose Branch ..... *
American Pulley Co. 256
American Pulverizer Co. 179
American Radiator & Standard Sanitary Corp. 245
Ames Iron Works ..... *
Anaconda Wire & Cable Co. 225
Anchor Packing Co. 185
Anderson Co., V. D. 317
Ansul Chemical Co., Dugas Div. 164
Arkansas Fuel Oil Co. ..... *
Armstrong Cork Co. 251
Armstrong Machine Works 40-41
Arnessen Electric Co. ..... *
Associated Piping & Engrg. Co. 136
Associated Valve & Engrg. Co. 338
Atlas Lumnite Cement Co. 345
Atlas Valve Co. 204

Babbitt Steam Specialty Co. 214
Babcock & Wilcox Co. 4-5,44-45
Babcock & Wilcox Tube Co. 232
Badger Fire Extinguisher Co. 329
Badger & Sons Co., E. B. ..... *
Bailey Meter Co. 14-15
Baldwin-Hill Co. ..... *
Baldwin Locomotive Works ..... *
Bartlett & Snow Co., C. O. 294
Bates Co., Walter 340
Beaumont-Birch Co. 367
Belmont Packing & Rubber Co. 228
Bernitz Furnace Appliance Co. ..... *
Betz, W. H. & L. D. ..... *
Biddle Co., James G. 180
Bigelow-Liptak Corp. ..... *
Bird-Archer Co. 240
Bird-White Co. 356
Blaw-Knox Co. ..... *
Boiler Tube Co. of America 348
Bonney Forge & Tool Works 141
Botfield Refractories Co. 228
Bowser, Inc. 278
Breuer Electric Mfg. Co. 224
Brickseal Refractory Co. 218
Bridgeport Brass Co. 307
Briggs Clarifier Co. 140
Bros Boiler & Mfg. Co. Wm. ..... *
Brownell Co. 340
Brown Instrument Co. 58B-58C
Brunt Equipment Co. 364
Buell Engineering Co. 216
Buffalo Forge Co. 301
Buffalo Pumps Inc. 241
Bull Dog Electric Products Co. 191
Burgess-Manning Co. 209
Burke Electric Co. 277
Bussmann Mfg. Co. ..... *
Byers Co., A. M. 62
Byron Jackson Co. 197

Canton Stoker Corp. ..... *
Carborundum Co. 300
Cardox Corp. 309
Carey Mfg. Co, Philip 289
Carrier Corp. 304
Cash Co., A. W. 201
Certified Gauge & Instrument Co. 168
Chapman Valve & Mfg. Co. 137
Chase Brass & Copper Co. ..... *
Chicago Metal Hose Corp. ..... *
Chicago Pneumatic Tool Co. ..... *
Cities Service Oil Co. ..... *
Clarage Fan Co. 308
Cleaver-Brooks Co. 246
Climax Engineering Co. 153
Cochrane Corp. 213, 230
Coffin Jr. Co., J. S. 355
Combustion Control Corp. 221
Combustion Engineering Co. 10-11
Condenser Service & Engrg Co. ..... *
Connery Construction Co. 154
Continental Foundry & Machine Co. ..... *
Cooper-Bessemer Corp. 38-39
Coppus Engineering Corp. 147
Corning Glass Works ..... *
Crane Co. 127
Crane Packing Co. 275
Crocker-Wheeler Electric Mfg. Co. 327
Cryer Trap & Valve Co. ..... *
Cuno Engineering Corp. 223
Cutler-Hammer, Inc. 115

Dampney Co. of America 177
Darling Valve & Mfg. Co. 243
Dart Mfg. Co., E. M. 156
Davis Engineering Corp. 318
Davis Regulator Co. 198
Dearborn Chemical Co. 157
De Laval Separator Co. 312
De Laval Steam Turbine Co. 58H, 234
Deming Co. 237
Detroit Stoker Co. ..... *
Diamond Power Specialty Corp. 8-9
Dixon Crucible Co., Joseph ..... *
Dodge Mfg. Corp. 207
Dollinger Corp. 252
Dominion Chemical Co. 352
Dowell, Inc. ..... *
Dura-Tred Co. 354
Dutton Co., C. H. 219

Eagle Picher Sales Co. 242
Economy Pumps Inc. 190
Eddington Metal Specialty Co. 220
Edge Moor Iron Works 310
Edward Valve & Mfg. Co. 121
Ehret Magnesia Mfg. Co. ..... *
Electric Controller & Mfg. Co. 209
Electric Fish Screen Co. ..... *
Electric Storage Battery Co. 239
Electro Metallurgical Co. ..... *
Elgin Softener Corp. 323
Elliott Co. 6-7
Engineer Co. 234
Enterprise Engine & Foundry Co. ..... *
Ernst Water Column & Gage Co. 346
Ess Instrument Co. ..... *
Eureka Packing Co. 212
Everlasting Valve Co. 346

Fairbanks Co. ..... *
Fairbanks, Morse & Co. 268
Fairfield Engineering Co. 123
Fairmont Coal Bureau ..... *
Falk Corp. 287
Farris Engineering Co. 184
Federal Telephone & Radio Corp. 288
Fisher Governor Co. ..... *
Fischer & Porter Co. 187
Fiske Bros. Refining Co. ..... *
Flexitallic Gasket Co. 260
Flexrock Co. 340
Flynn & Emrich Co. 50
Foreston Coal Co. ..... *
Foster Engineering Co. 334
Foster Wheeler Corp. 24-25
Fostoria Pressed Steel Corp. 202-203
Foxboro Co. 341
France Packing Co. ..... *
Frederick Iron & Steel Co. 363
Frick Co. 362
Fuller Co. 214
Fulton Sylphon Co. 282
Fyr-Feeder Spreader Stoker 346

Gardner-Denver Co. 270
Garlock Packing Co. 305
General Coal Co. 162
General Electric Co. 12-13, 34, 145, 206
Gifford-Wood Co. 255
Gilmer Co., L. H., Div. of U. S. Rubber Co. 319
Globe Steel Tubes Co. ..... *
Goetze Gasket & Packing Co. 231
Golden-Anderson Valve Specialty Co. 303
Goodall Rubber Co. 176
Goodyear Tire & Rubber Co. 46
Goulds Pumps, Inc. 247
Graham Mfg. Co. 361
Graton & Knight Co. ..... *
Graver Tank & Mfg. Co. ..... *
Graybar Electric Co. 217
Green Fire Brick Co., A. P. ..... *
Grinnell Co. ..... Third Cover
Griscom-Russell Co. 281
Grove Regulator Co. ..... *
Gulf Oil Corp. 335
Gulf Refining Co. 335

Hagan Corp. 58-58A
Hall Laboratories 42-43
Haynes Stellite Co. 271
Hays Corp. 265
Hays Institute of Combustion 226
Heacon., Inc. 274
Heat Transfer Products Inc. 212
Hendy Iron Works, Joshua 257
Henszey Co. 210
Hercules Float Works 228
Hill Pump Valve Co. ..... *
Hoffman Specialty Co. ..... *
Homestead Valve Mfg. Co 353
Honan-Crane Corp. 194
Hoppes Mfg. Co. 350

Imperial Brass Mfg. Co. 272
Industrial Gear Mfg. Co. 344
Inflico, Inc. ..... *
Ingersoll-Rand Co. 293
International Boiler Works Co. ..... *
International Nickel Co. 35, 211
Iron Fireman Mfg. Co. ..... *

Jefferson Union Co. 208
Jeffrey Mfg. Co. 261
Jenkins Bros. 132-133
Johns-Manville, Inc. 129
Johnson Service Co. 315
Jones & Laughlin Steel Corp. 350
Jones Foundry & Machine Co. W. A. 199

Keasbey & Mattison Co. 337
Keeler Co., E. ..... *
Kellogg Co., M. W. 163
Kennedy Valve Mfg. Co. 171
Kennedy-Van Saun Mfg. & Engr. Corp. 32-33
Kewanee Boiler Corp. 338
Kieley & Mueller Inc. 284

Laminated Shim Co. 142, 178
Leavitt Machine Co. 215
Leeds & Northrup Co. ..... *
Leslie Co. 313
Lincoln Electric Co. ..... *
Linde Air Products Co. 286
Link-Belt Co. 3
Liquidometer Corp. 358
Locke Regulator Co. ..... *
Lonergan Co., J. E. 365
Ludriplate Div., Fiske Bros Refining Co. *
Ludlow Valve Mfg. Co. 174
Lummus Co. ..... *
Lunkenheimer Co. 58D-58E

Macmillan Petroleum Corp. ..... *
MacWhyte Co. 366
Magnolia Metal Co. ..... *
Manhattan Rubber Mfg. Div., Raybestos-Inc. 235
Manheim Mfg. & Belting Co. 238
Manzel Brothers Co. 360
Marley Co. 292
Marsh Corp., James P. ..... *
Mason-Neilan Regulator Co. 357
Maxim Silencer Co. 263
McAlear Mfg. Co. 167
McGraw-Hill Book Co. 348
Mercoid Corp. 344
Midwest Piping & Supply Co. 165
Minneapolis-Honeywell Regulator Co. ..... *

Mitchell Co., W. K. 166
Modine Mfg. Co. 347
Monsanto Chemical Co. 222
Murray Iron Works Co. 230

National Airoil Burner Co. ..... *
National Aluminate Corp. 131
National Electric Products Corp. 193
National Supply Co. 296
National Tube Co. 331
National Valve & Mfg. Co. 320
Niagara Blower Co. ..... *
Nicholson Co., W. H. 363
Nordberg Mfg. Co. ..... *
Northern Equipment Co. 135
Norton Co. 326
Nugent Co. W. W. 360
Nutmeg Chemical Co. 344

Oakite Products Inc. 222
Ohio Injector Co. 183
Orr & Sembower, Inc. 352
Otis Elevator Co. 324
Owens-Coning Fiberglas 298

Pacific Pumps Inc. 195
Peabody Engineering Corp. ..... *
Penn Flexible Metallic Tubing Co. 343
Pennsylvania Pump & Compresser Co. 365
Permutit Co. 206, 311
Philadelphia Gear Works 159
Photoswitch, Inc. ..... *
Pipe Fabrication Institute 316
Pittsburgh Piping & Equipment Co. 249
Pittsburgh Steel Co. ..... *
Plant Rubber & Asbestos Works 253
Plibrico Jointless Firebrick Co. 389
Powell Co., Wm. 36-37
Powers Regulator Co. 216, 364
Prat-Daniel Corp. 233
Preferred Utilities Mfg. Corp. 182
Pritchard Co., J. F. 173
Proportioneers, Inc. ..... *
Punch-Lok Co. 367

Quaker Rubber Corp. ..... *

Randolph Laboratories ..... *
Raybestos Manhattan ..... *
Raytheon Mfg. Co. ..... *
Reading, Pratt & Cady Div. 359
Reeves Pulley Co. 254
Reliance Electric & Engrg. Co. ..... *
Reliance Gauge Column Co. 56-57
Republic Flow Meters Co. 52-53
Republic Rubber Div. (Lee Tires & Rubber Corp.) ..... *
Republic Steel Corp. 20-21
Research Corp. 314
Revere Copper & Brass, Inc. 175
Rhoads & Sons Co., J. E. 356
Richardson Scale Co. 220
Rie-Wil Co. 250
Ridge Tool Co. 342
Riley Stoker Corp. 96-97
Robins Conveyors, Inc. 258
Rockbestos Products Corp. 336
Roeblings Sons Co., John E. 302
Roper Corp., Geo. D. 160
Ross Heater & Mfg. Co. ..... *
Roto Division of Elliott Co. 212
R-S Products Corp. 208
Ruberoid Co. 297

Saree Co. Inc. 143
Sauerman Bros. Co. 362
Saverite Engineering Co. 210
Schramm, Inc. 144
Schutte & Koerting Co. 328
Scovill Mfg. Co. 16-17
Shaw Co., B. F. 149
Sier-Bath Gear Co. 244
Sinclair Refining Co. 333
Stryer Steel Casting Co. 227
Skinner Engine Co. 306
SKF Industries 330
Sloan Valve Co. 235
Smith Refractories, Sanford C. 364
Smooth-On Mfg. Co. 358
Socony-Vacuum Oil Co. ..... Back Cover
Springfield Boiler Co. 19
Square D. Co. 200
Squires Co., C. E. 350
Standard Oil Co., of Calif. 290
Standard Oil Co., of Indiana 151-152
Star Electric Motor Co. 283
Star Fuse Co. 354
Steel & Tubes Div. 20-21
Stephens-Adamson Mfg. Co. 51
Sterling Engine Co. 161
Sterling Engrg. & Mfg. Corp. 224
Stickle Steam Specialties Co. 158
Stock Engineering Co. 344
Strong, Carlisle & Hammond Co. 279
Struthers Wells Corp. ..... *
Sturtevant Co., B. F. 26-27
Sturtevant Mill Co. 148
Sullivan Machinery Co. 321
Sun Oil Co. 119
Superior Engine Div. 296
Swartwout Co. 392
Syntron Co. 364

Taylor Co., W. A. ..... *
Taylor Forge & Pipe Works 236
Taylor Instrument Co's. 349
Templeton Mfg. Co. 324
Terry Steam Turbine Co. 58F-58G
Texas Co. 22-23
Thermix Engineering Co. 233, 274
Thermoid Rubber Div. 29, 45
Tide Water Associated Oil Co. 30-31
Timken Roller Bearing Co. 225
Todd Shipyards Corp. (Combustion Equipment Div.) ..... *
Toledo Pipe Threading Machine Co. ..... *
Tripp Metallic Packing Co. 364
Troy Engine & Machine Co. 248
Tube Turns, Inc. 139

Union Asbestos & Rubber Co. ..... *
Union Carbide & Carbon Corp. ..... 2nd I., 286
Union Chain & Mfg. Co. 280
Union Iron Works 318
United States Gauge Co. 189
U. S. Gasket Co. ..... *
U. S. Motors Corp. ..... *
U. S. Rubber Co. 85

Valvoline Oil Co. 204
Viking Pump Co. 366
Vogt Machine Co., Henry 48-49

Wallace & Tiernan Products Inc. 170
Walworth Co. 267
Warren Steam Pump Co. 339
Watson-Stillman Co. 155
Webster & Co., Warren 269
Wedge Protectors, Inc. 356
Wellman Co., S. K. ..... *
Western Chemical Co. 224
Westinghouse Electric & Mfg. Co. 60-61
Weston Electrical Instrument Corp. 226
Wheelco Instruments Co. ..... *
Wheeler Mfg. Co., C. H. 214
Where To Buy 364
Whitlock Mfg. Co. 354
Wiedeke Co., Gustav ..... *
Wilkening Mfg. Co. 332
Williams Gauge Co. 138
Wilson, Inc., Thomas C. 188
Wing Mfg. Co., L. J. ..... *
Woods Sons Co., T. B. ..... *
Worthington Pump & Machinery Corp. 262, 291
Wrigley Jr. Co., Wm. 342

X-Pando Corp. ..... *
Xzit Sales Co. ..... *

Yarnall-Waring Co. 117, 196, 259
Yeomans Brothers Co. ..... *
Youngstown Sheet & Tube Co. 205

Zallea Brothers & Johnson ..... *
Zink Co., John 388

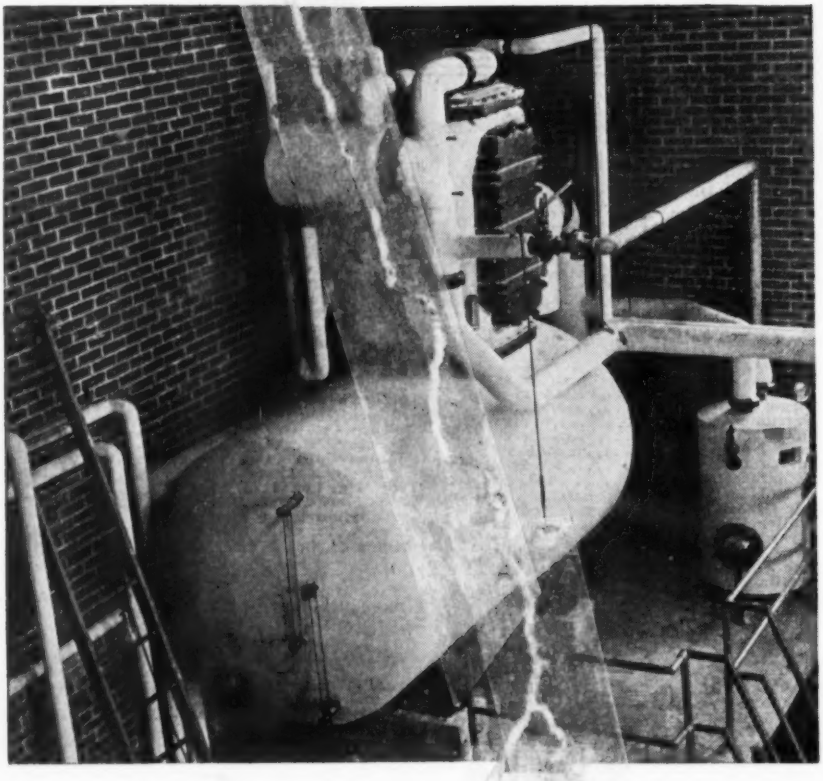
PROFESSIONAL SERVICES 362-363

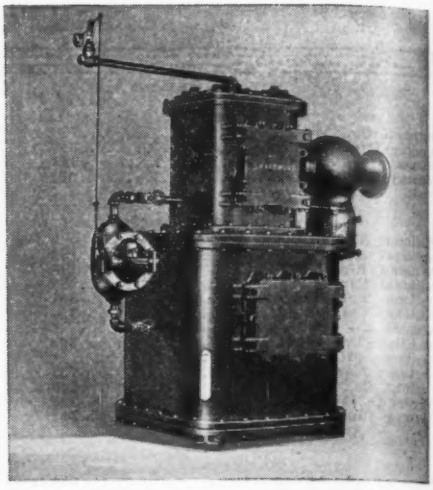
SEARCHLIGHT SECTION

(Classified Advertising)

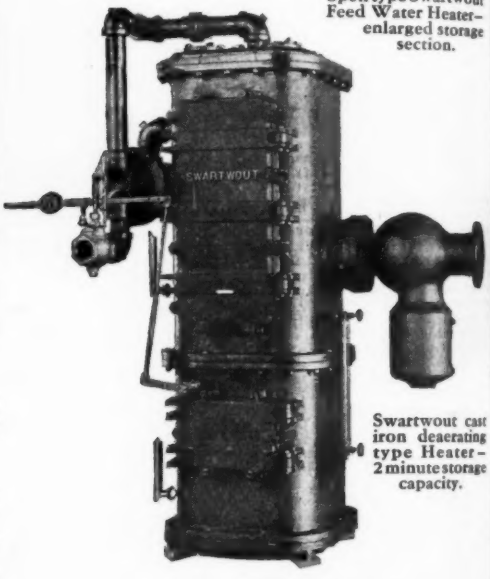
CLASSIFICATION	PAGE
EMPLOYMENT SERVICES	367
POSITIONS VACANT	365, 366, 367
POSITIONS WANTED	368
REPAIRING	368
SELLING OPPORTUNITIES	368
USED EQUIPMENT	368-388

Acme Equipment Co. 861
Aljon Electric Diesel Co. 384, 387
American Air Compressor Corp. 385
Arnessen Electric Co. 384
Askew, A. C. 387
Atlantic Transformer Co. 385
Anderson, Fred J. 388
Belyea Co., Inc. 371
Benjamin's For Motors 387
Berger Bros. Electric Motors, Inc. 373
Birch Manufacturing Co. 385
Brearley H. P. 384, 386, 387
Brew, Woltman & Co., Inc. 376
Broaddus, W. L. 387
Chicago Electric Co. 378
Cohen & Co., Lou 384
Consolidated Badger Cooperative 386
Crawbuck Co., John D. 382
Crowley-Duers Co. 386
Davis Co., J. F. 388
Douglass Co., Stephen A. 383
Duquesne Eelctric & Mfg. Co. 381
Ebasco Services, Inc. 386
Electric Apparatus Repair Co. 385
Electric Equipment Co. 385
Electric Motor & Repair Co. 383
Electric Service Co., Inc. 384
Electrical Engr. & Equip. Co. 388
Electro-Tech Equipment Co. 368
Ellis Co., A. Lee 376
Emsco Equipment Co. 382, 386
Erie Electric Co., Inc. 380
Farley & Loetscher Mfg. Co. 387
Fletcher Sales Co. 384
Ford Roofing Products Co. 388
General Machinery & Equipment Co., Inc. 386
Glow Electric Co. 379
Greenspon's Son Pipe Corp., Jos. 385
H & P Machinery Co. 387
Hall & Co., Stephen 383
Hay & Co., F. W. 386
Heat & Power Co. 380
Hemphill & Co., Inc., J. L. 369
Hobson, Russell B. 387
Holyoke Water Power Co. 387
Howe Brothers 382
International Power Machy. Co. 375
Iron Steel Products Inc. 388
Johnson & Assoc., Howard Blaine 387
Keystone Power Plant Eq. Co. 376
Klemle Co., Fred W. 373
Klirk Co., Wallace E. 382
Land & Co., L. J. 372
Metzler, A. 388
Metropolitan Plumbing Supply Co., Inc. 384, 387
Mississippi Valley Equipment Co. 379
Moorehead-Reitmeyer Co. 383
Nelson Machinery Co. 388
O'Brien Machinery Co. 374
Oreland Equipment Co. 388
Penn Machinery Co. 386
Physical Culture Hotel 388
Power Equipment Co. 368, 382
Power Plant Equipment Co., Inc. 378
Procter-Canner's Cooperative Inc. 386
Rearick, Charles B. 383
Righter, Harry M. 388
Republic Textile Eq. Co. 377
Rockford Electric Equipment Co. 384
Ross Power Eq. Co. 384, 386
Schoonmaker Co., A. G. 385
Schoonmaker, Robert 379, 382, 383, 385, 387
Stanhope, Inc., R. C. 382
Stewart & Co., Paul 381
Superior Equipment Co. 386
Textile Equipment Co. 368
Trianon Lanes 388
Universal Tool Co. 368
Utilities Electric Machinery Co. 370
Vogt Machine Co., Henry 388
Wagner Co., Arthur 379
Wente Electric Co. 385
Wilms, Weaver & Co. 382
Wurth Electric Motor Motor Co. 387





Cast iron standard open type Swartwout Feed Water Heater—enlarged storage section.

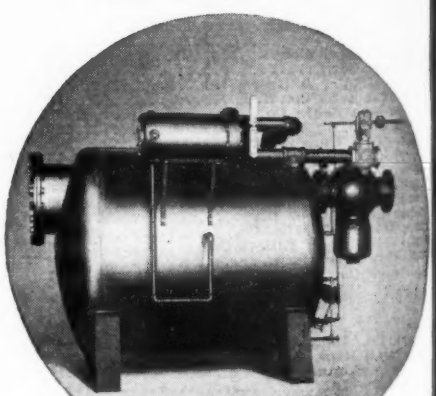


Swartwout cast iron deaerating type Heater—2 minute storage capacity.

The Proved Ability of Swartwout Feed Water Heaters

to remove oxygen and mineral solids from feed water means less outage and lower maintenance. Your problem can be met with one of many styles of these rugged Swartwout Heaters. . . .

Your constant aim for greater efficiency and economy in power production is assisted by adequate feed water preheating, deaerating and purifying facilities. Swartwout Feed Water Heaters make unusual records every day in hundreds of plants—exceed the guaranteed oxygen removal and maintain the supply of properly heated water. You seldom buy a heater from a price list. Each Swartwout Heater is engineered to fit its job while built to standard time-tried Swartwout principles of design. Write us or ask your consulting engineer about Swartwout Heaters.



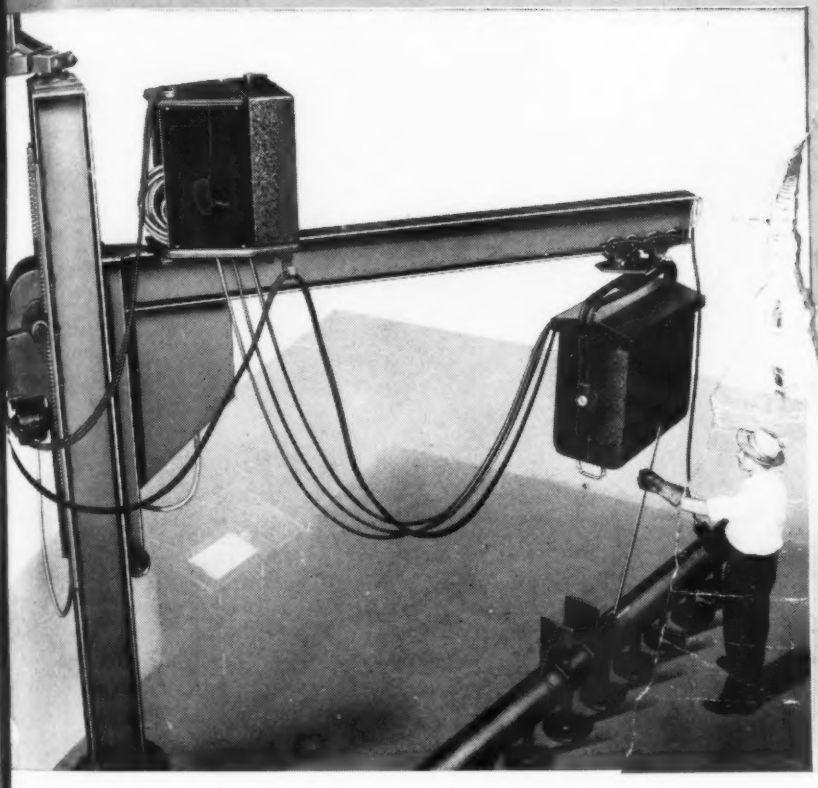
All steel horizontal Swartwout Deaerating Heater for use where head space is restricted.

Swartwout POWER PLANT EQUIPMENT

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio

Danger-Proofed Piping

...BECAUSE IT'S X-RAY INSPECTED



X-RAY

GAMMA-RAY

Y specifying *X-Ray or Gamma Ray inspection,* you can be absolutely positive that fabricated piping has no idden welding flaws.

Grinnell's scientific inspection methods and equipment ake doubly sure that welded joints will safely withstand e high temperatures and pressures called for in today's ower and process piping systems.

250,000 volt X-ray "eyes", so sensitive they will record e scratch of a needle on metal, search each weld through nd through for the most minute flaws. Portable Gamma Ray equipment is used for inspection in the field.

When you give a prefabricated piping job to Grinnell, you can be sure of expert interpretive engineering, unexcelled laboratory research, modern fabricating facilities and positive inspection.

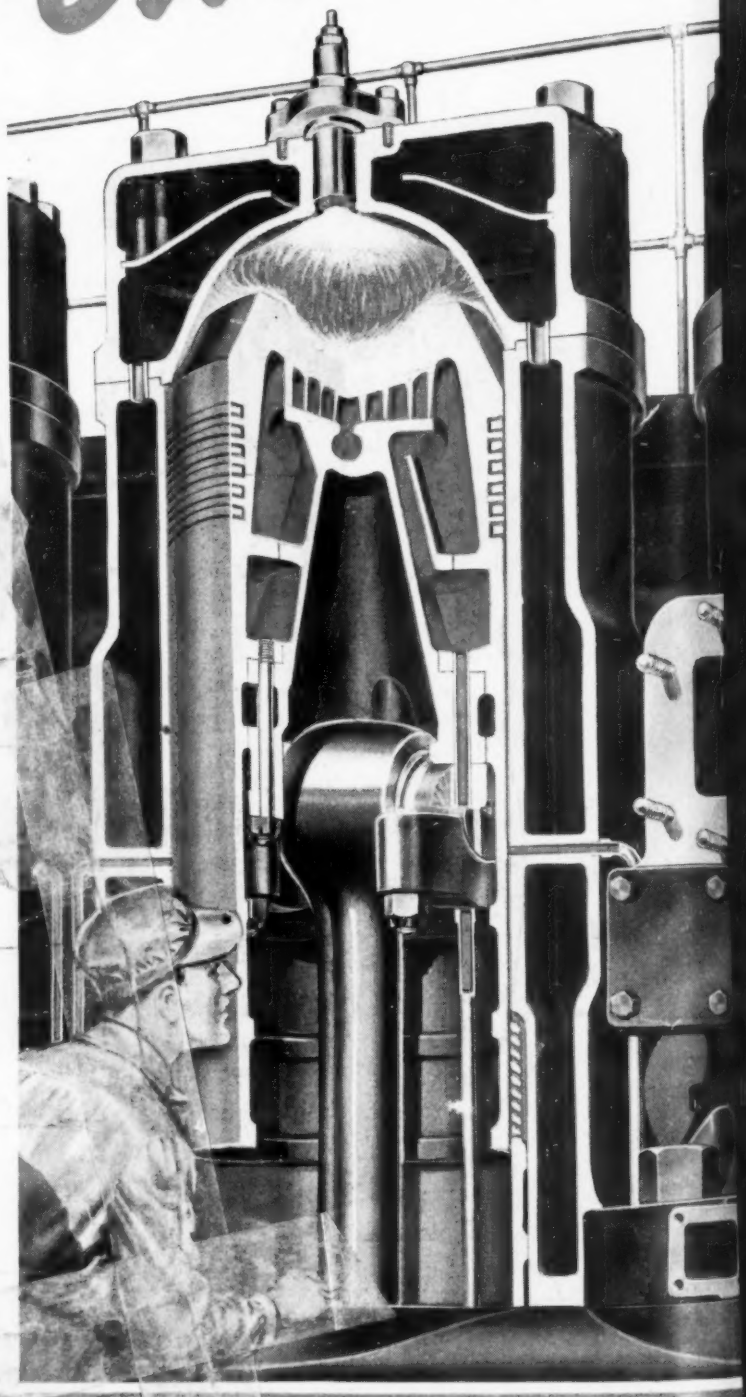
• • •

GRINNELL COMPANY, INC.
Executive Offices, Providence 1, R. I.
Branch warehouses in principal cities
Pipe Fabrication Plants:
Providence, R. I. • Atlanta, Ga. • Warren, Ohio

GRINNELL

WHENEVER PIPING IS INVOLVED

ONE WAY TO GET FULL POWER!



Make Certain Your Diesel Lubricating Oil Will Keep Rings Free, Prevent "Blow-by"!

HERE, in the ring zone of your Diesel engine, combustion makes things plenty hot. Unless your lubricating oil can take this heat, it will "cook," form hard deposits that cause ring sticking.

Loss of valuable power due to "blow-by" is the inevitable result.

Gargoyle D. T. E. Oils Nos. 1 to 5 are specially designed to withstand the terrific heat in Diesel ring zones . . . to keep rings free.

These famous oils reduce deposits to an absolute minimum, and those that do form, are soft and flaky.

Just as important, these Gargoyle D. T. E. Oils provide strong films that resist rupture and reduce wear on pistons, cylinders and rings.

You get full power — and your Diesel stays on the job longer with less "down-time" for repairs and replacements.

SOCONY-VACUUM OIL CO., INC.

Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corporation of California.

GET CORRECT LUBRICATION FOR YOUR ENTIRE PLANT WITH SOCONY-VACUUM ENGINEERING

GARGOYLE Lubricants

Socony-Vacuum's FIVE STEPS to Lower Production Costs for You

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Counsel
5. Progress Reports of Benefits Secured